

CRAYFISHES OF THE OUACHITA NATIONAL FOREST, ARKANSAS

The Final Report to

USDA Forest Service
Ouachita National Forest
Hot Springs, Arkansas

by

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INTRODUCTION

Crayfishes are an important part of aquatic habitats as they are often the largest and most common invertebrates in Arkansas streams and lakes. Crayfishes serve as an important food source for many game fishes such as smallmouth bass and wildlife such as otters, minks, weasels, and raccoons. They facilitate important ecological processes, sustain recreational and commercial bait fisheries, and serve as profitable and popular food resources (Taylor et al. 1996).

Unfortunately, little has been done in regard to the scientific study of crayfishes in Arkansas in general and in the Ozark Mountains physiographic region in particular. Although often encountered by professional biologists, fishermen, and naturalists alike, the main deterrent to a critical understanding and appreciation of crayfishes by the nonspecialist lies in the certain difficulty in identifying them to species. Except for Williams' (1954) monograph on crayfishes of the Interior Highlands, both biologists and resource managers have little valid information as to which crayfish species occur within their particular areas.

The present study of the crayfishes of the Ouachita National Forest (ONF) in Arkansas was initiated in an effort to elucidate the crayfish fauna of this geographic area (Map 1). Such a study has great utility to professional resource managers responsible for the wildlife component of the Ouachita National Forest ecosystem.

The purposes of this study were primarily four-fold: (1) to

determine the species of crayfishes inhabiting the ONF in Arkansas; (2) to assess the abundance and distributional limits of the crayfish species within the ONF; (3) to gather life history information seasonally on the various species of crayfishes within the Forest; and (4) to assess the current status of each of the crayfish species based upon distributional and abundance data assembled from this study.

MATERIALS AND METHODS

Field work for this project was conducted from April, 1996 through September, 1997. A total of 251 collections of crayfishes was made which resulted in 2,274 individuals being taken in an effort to document the crayfish fauna of the Ouachita National Forest (Table 1, Map 1). Many of the specimens were released unharmed following careful identification while voucher series were made of others. Collecting localities visited during the two-year study are shown in Map 2. Collecting was concentrated in the ONF streams and rivers and additionally in wet seepage areas specifically for burrowing crayfish species. Much of the field work occurred during the fall, spring and summer to utilize optimal field conditions.

A variety of collecting methods were used in the documentation of the ONF crayfish fauna including the use of common sense minnow seines, one-man seine, electroshocking equipment, aquatic dip nets, baited and unbaited crayfish traps, and by physically digging the burrowing specimens from their burrows.

Selected specimens were kept alive in a cooler and transferred to Southern Arkansas University in Magnolia, AR where photographs were made of the best specimens. Representative specimens from each collecting site were preserved in 60% isopropyl alcohol for later study. Preserved specimens were deposited in the Southern Arkansas University Invertebrate Collection and the Smithsonian Institution Crayfish Collection after careful study of individual variation among species.

In addition to collections made during this survey, museum specimens housed at the Smithsonian Institution, Washington, D.C. and Southern Arkansas University were studied to document the identifications and distributions of the crayfish species. All previous literature dealing with Arkansas crayfish species was reviewed and distributional information was utilized when deemed accurate.

HISTORICAL REVIEW

The first recorded mention of a crayfish from the state of Arkansas was Hagen (1870). Few additional references can be found to Arkansas crayfishes until the late 1940s and 1950s. Of special importance to students of crayfishes of the Ouachita Mountains of Arkansas is Williams (1954). Although badly outdated now, it remains the foundation from which to start any serious investigation of area crayfishes. Reimer (1963) completed a master's thesis on the crayfishes of Arkansas and included records for the Ouachitas. Reimer (1966) described Fallicambarus strawni from Howard County. Fitzpatrick (1978)

later described Procambarus liberorum from near Fayetteville.

Bouchard and Robison (1980) presented an inventory of the species of crayfishes living in Arkansas and provided data on general habitats of crayfishes in all physiographic regions of the state. Hobbs and Robison (1988) described two new species of Procambarus from Arkansas and provided a key to the species of the burrowing subgenus Girardiella. In addition, distributional information was updated on all species of the subgenus. Hobbs and Robison (1989) investigated the Arkansas species of the genus Fallicambarus and described two new species.

DESCRIPTION OF THE AREA

The Ouachita National Forest is the oldest and largest National Forest in the South, comprising 1,763,774 acres in Arkansas and Oklahoma (Mr. Richard Standage, pers. comm.) (Map 1). Of this total, 1,417,625 acres of the ONF occur in Arkansas. In Arkansas the ONF is situated primarily in the Ouachita Mountains physiographic region and contained within portions of Montgomery, Polk, Garland, Logan, Perry, Scott, and Yell counties.

The ONF is drained by three large river systems: the Arkansas River system to the north and west and the Red River (Little River drainage) and Ouachita River systems in the southern portion. Drainages of the Arkansas River system within the ONF include the Poteau River, Petit Jean River, and Fourche la Pave River. The Red River system (Little River Drainage) is represented by the Mountain Fork, Cossatot, and Saline rivers

while the Ouachita River is represented by the mainstem Ouachita River, Caddo River, Little Missouri River, eastern Saline River (with its three forks), and a multitude of smaller tributaries.

GENERAL ASPECTS OF CRAYFISHES

General Considerations

Crayfishes are a most important and integral component of aquatic ecosystems found throughout Arkansas. In many streams, sport fishes such as sunfishes and basses (family Centrarchidae) may consume up to two-thirds of the annual production of crayfishes (Taylor, et al. 1996). Crayfishes contribute to the maintenance of food webs by processing vegetation and leaf litter (Huryn and Wallace, 1987; Griffith, et al. 1994), which increases the availability of nutrients and organic matter to other aquatic and terrestrial organisms.

Crayfishes are members of the most numerous of all animal groups, the arthropods or joint-legged animals. They are classified as crustaceans because of their possession of two pair of antennae and the fact that they breathe by gills. Crayfishes are protected by a heavily armoured exoskeleton and have five pairs of walking legs, the first of which functions as enlarged pincers (chelipeds) (Figure 1).

Approximately 450 species of crayfishes occur worldwide and about 338 are found in the United States and Canada (Pflieger, 1996; Taylor, et al. 1996). Arkansas has 53 crayfish species (Bouchard and Robison, 1980; Taylor, et al. 1996; H. W. Robison, personal data) belonging to one family, Cambaridae, and

classified into seven genera. The genus Procambarus slightly dominates the crayfish fauna of Arkansas 18 species, while the genus Orconectes is represented by 16 species, Fallicambarus with eight species, Cambarus with six species, Cambarellus and Faxonella with two species each, and Bouchardina with a single species. Several additional undescribed species of crayfishes are known from Arkansas, but formal scientific descriptions of them are not yet completed.

Prior to discussion of the various crayfishes documented from the ONF, a brief overview of several basic life history aspects involving crayfishes, general taxonomic points, and ecological considerations are presented.

Basic Life History Cycle

Although highly variable, most crayfishes in Arkansas mate between September and March. Form I males (breeding males) seek out receptive females and mating is accomplished. Sperm are carried by the female until oviposition (egg laying) which may be in March, April and May, although some species begin as early as December or January (Page, 1985). Following oviposition, the eggs are attached to the underside of her abdomen and females are said to be ovigerous or "in berry." Females carry the eggs for 2-20 weeks depending on the water temperature (Page, 1985). After hatching, young move quickly through a series of molts until sexual maturity is reached by late summer or early fall.

Little is known about the specifics of the life cycles of the particular species which inhabit the Ouachita National Forest.

Taxonomic Considerations

The taxonomy of North American crayfishes is based upon numerous morphological characteristics (See Hobbs, 1972). The secondary sexual characters are actually the most important for identification purposes, such as the annulus ventralis, copulatory hooks, bosses on the coxae of some pereopods (=walking legs), and first pleopods (Bouchard and Robison, 1980). The morphology of the male's first pleopods is the single most important character in identifying most species and practically all of the genera of North American crayfishes, including the crayfishes of the ONF.

In crayfishes of the family Cambaridae, adult males exhibit two morphological forms during the year, molting into these conditions with only the first form (form I) males capable of breeding. The second form, or form II male is sexually nonfunctional (Bouchard and Robison, 1980). The first pleopod (or gonopod) of the form I male has delicate, finely sculptured elements, at least one of which consists of amber, corneous material. The first pleopod of the form I male is easily distinguished from the form II gonopod which has elements usually reduced in length and/or more inflated and without a corneous deposit (See Hobbs, 1972a). Also reduced in size are the remaining secondary sexual characters such as the chelae.

It is therefore many times imperative to the person wishing to identify the species in question to have a first form male to make positive identifications. Juveniles and female specimens

are always more difficult to identify to species level.

Ecological Categories

The crayfishes of Arkansas can be grouped into three broad, overlapping, ecological categories (Bouchard and Robison, 1980). There are those species that inhabit the diverse surface water habitats (epigeaners), those species that utilize underground solution channels in limestone regions (cavernicoles), and those species that burrow into the subsurface water table (burrowers). Because these categories are not rigid, there is some overlap among groups.

Hobbs (1942) recognized three categories of burrowers and this classification has been found useful to crayfish workers, i.e. primary burrowers, secondary burrowers, and tertiary burrowers. Hobbs (1981) characterized primary burrowers as crayfishes that spend almost their entire lives below the surface of the ground, only occasionally leaving their lairs on brief forays on land, presumably searching for food, and at times, a mate. Seldom are the burrows in connection with bodies of open water. Primary burrowers inhabit burrows where for most of the year the water table does not drop more than a meter or so beneath the surface. Typically these areas may be easily recognized by the presence of hydrophilic sedges. Many times these areas occur near the roadbed. Secondary burrowers generally occupy burrows but may wander into the open water during periods of rainy seasons. Tertiary burrowers burrow only in periods of drought or occasionally during the breeding season.

The rest of the year they inhabit streams or other permanent or semi-permanent bodies of water.

CRAYFISHES OF THE OUACHITA NATIONAL FOREST

A total of 12 species of crayfishes classified in four genera (Cambarus, Fallicambarus, Orconectes, and Procambarus) was documented from the ONF during the two-year study (Table 2). Approximately 2,300 individual crayfish were collected from the ONF during the two-year study in an effort to document the crayfish fauna (Table 3).

Arkansas has 53 species inhabiting the state, the most of any state west of the Mississippi River (Bouchard and Robison, 1980; Taylor, et al. 1996). The ONF thus has about 23 percent of the total crayfish fauna of Arkansas represented by species within its boundaries.

Table 3 provides the abundance of the 12 individual crayfish species documented from the ONF during this study. Abundance was divided into four categories: abundant, common, uncommon, and rare. A species was considered **rare** if two or fewer collections were made. If 3-10 collections were made of the species, it was considered **uncommon** while 10-20 collections provided a species with a designation of **common**. These designations are not meant to imply overall conservation status, but rather simply to provide the reader with some idea of what to expect regarding the abundance of these crayfishes on the ONF.

The two most abundant crayfish species within the streams and rivers of the ONF were Orconectes palmeri longimanus and

Orconectes acares (Table 3). Both occurred in most collections made from lotic situations within the ONF.

Orconectes leptogonopodus was considered common on the ONF while O. sp. nov., Procambarus acutus, P. liberorum, and P. reimeri were deemed uncommon. Rarely taken from the ONF were Orconectes menae, Fallicambarus strawni, Procambarus ouachitae, and P. tenuis (Table 3). Although not collected during this study, Procambarus parasimulans was considered rare on the ONF.

Crayfish habitat for lotic species such as Orconectes palmeri longimanus, and O. acares is quite abundant on the ONF and a large number of individuals of each species was collected by lifting large flat rocks lying in the stream or at stream margins or by seining swift flowing shoal areas. Headwater areas of all ONF streams had abundant crayfish habitat and crayfishes were common at most places searched.

In addition to lotic habitat, a limited amount of lentic habitat occurs within the Ouachita National Forest from both natural and man-made sources. Lake Winona, Iron Fork Lake, and of course Lake Ouachita are some examples of man-made lentic environments. In addition, a number of Forest Service ponds constructed as wildlife watering areas are available as crayfish habitat with species such as Orconectes palmeri longimanus proving extremely abundant in some of these.

Burrowing habitat in the form of seepage areas, fields, and roadside ditches is rather abundant throughout the ONF in addition to the numerous seeps and spring areas. The ONF lies in

the heart of the distributions of some of the most interesting burrowing crayfishes. Although generally uncommon except in certain specific habitats and at precise times of the year, primary burrowers of the ONF were Fallicambarus strawni, Procambarus liberorum, P. parasimulans, and P. reimeri.

Distributionally, the greatest diversity in crayfish species occurred in the Ouachita River drainage (Table 4), as six species were collected within its confines. The Little Missouri River drainage yielded five species while three species were taken from the Caddo River, Poteau River, and Fourche la Pave River (Table 4).

SPECIES ACCOUNTS

The following are species accounts of all crayfishes known to occur within the boundaries of the ONF. Data is presented on the diagnostic characters of each species including taxonomic morphological characters and coloration of both males and females, the distributional range of each species both within the United States and Arkansas in general, and within the ONF in particular, and a description of the habitats frequented by each species. Under "Localities Collected" the numbers given refer to precise collecting localities given in Table 1 in the Appendix.

Fallicambarus strawni (Reimer)

Map 3

Recognition Characters: Rostrum lacking marginal spines with indistinct acumen. The areola is obliterated. Spines absent

along surface of carapace. Antennal scale widest at midlength. Abdomen narrower than thorax and shorter than carapace. Chela strongly depressed; carapace and chela lacking conspicuous setiferous punctations. Hooks on ischiopodites of third pereopods only, of male. First pleopod of Form I male terminating in three distinct processes bent at approximately a 90 degree angle to main shaft.

Coloration: Dominant coloration of the carapace is pinkish cream overlain by markings of various shades of gray and vermilion. Most of the dorsum of the cephalic region is pink, fading laterally to buff with lavender suffusion. Rostrum and postorbital ridges are very dark gray. The caudal gastric area and cervical groove is pale gray. Tergum of first abdominal segment and cephalic part of second abdominal segment maroon. Terga of other segments yellowish tan, vermilion splotches dorsally. Telson largely translucent but with vermilion to brick-red splotches cephalically, laterally, and along caudal margin. Chelipeds basically tan with dense reticulations of intense dark grayish-blue dominating dorsum of distal half of merus and that of carpus. All tubercles very dark blue, almost black. Ventral surface of body cream colored.

Size: Adults mature at a length of two to three inches.

Habitat: Hobbs (1989) presented the habitat of this primary burrowing species as burrows, both simple and complex.

General Range: Arkansas endemic (see below).

Range Within Arkansas: This crayfish is confined to the Saline

River basin in Sevier, Howard, and Pike counties, Arkansas (Hobbs, 1989).

Localities Collected: 187, 206, 207.

Comments: The type locality of this primary burrowing species is a small marshy area in the Saline River drainage, 2.7 miles (4.3 km) north of Dierks, Howard County, Arkansas (Reimer, 1966)

Only five specimens were collected from three localities within the ONF rendering this crayfish a rare member of the ONF crayfish fauna (Table 3).

First form males have been collected in April and June. No ovigerous females have been taken; however a female from Pike County laid yellowish-orange eggs on May 17 (Hobbs, 1973).

***Orconectes acares* Fitzpatrick**

Map 4

Recognition Characters: Rostrum with marginal tubercles or spines, median carina present, margins subparallel or slightly converging cephalad, not thickened. Length of areola 29.1 to 33.7 percent of total length of carapace, 5.5 to 7.0 times longer than broad, three to five punctations in narrowest part. Postorbital ridges strong, divergent, corneous spines or tubercles; sides of carapace lacking lateral spines. First pleopod of first form male reaching caudal margin of coxopodite of first pereopod with abdomen flexed; central projection with strong cephalic shoulder near base; central projection straight, longer than mesial process, setiform and straight almost to tip;

mesial process, slender, with tip curving caudodistally; mesial process straight, setiform, slender, delicate; tips of first pleopod divergent and bent mesiad near tip. Chela depressed but palm somewhat inflated; all surfaces bearing setiferous punctations.

Coloration: Body color slate gray with telson and uropods fuscus. Chela slate gray with undersides off-white. Body color off-white to pinkish. Distinctive dorsolateral paired bright red spots on tergal segments three, four, and five. A red bar runs across tergal segment six. Cheeks and lower edge of the gill cover with pinkish streaks.

Size: Adults are about one to three inches in length.

Habitat: This stream dwelling species inhabits rapidly flowing water on or near shoals of streams as well as in spring outflows.

General Range: Arkansas endemic (Robison and Allen, 1995).

Range Within Arkansas: Hobbs (1989) presented the range of Orconectes acares as the tributaries of the Ouachita River in Garland, Hot Springs, Montgomery, Perry, Pike, Polk, and Saline counties, Arkansas.

Localities Collected: 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 20, 21, 23, 24, 26, 27, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 46, 48, 49, 450, 51, 52, 53, 54, 55, 56, 57, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 101, 102, 103, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 123, 124,

125, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163,
 164, 165, 166, 167, 203, 204, 205, 208, 209, 210, 211, 212, 213,
 215, 216, 217, 227, 228, 230, 231, 232, 233, 234, 235, 251

Comments: The type locality of this species is a stream tributary to the Ouachita River six miles (9.6 km) northwest of Mount Ida, Montgomery County, Arkansas (Fitzpatrick, 1965).

Orconectes acares was collected at 125 of the 251 sites during the study for a total of 1,258 specimens. This Ouachita River endemic has its distribution centered within the ONF and thus its high abundance should be expected. Together with Procambarus palmeri longimanus, O. acares is one of the two most abundant crayfish species on the ONF.

Orconectes leptogonopodus Hobbs

Map 5

Recognition Characters: Rostrum with lateral spines, margins somewhat thickened and slightly convex laterad. Areola about five times longer than broad with three to five punctations in narrowest part - length about 32 percent of entire length of carapace; postorbital ridges terminating cephalad in heavy coneous spines; sides of carapace devoid of spines; antennae shorter than body; in male, hooks on ischiodites of third pereopods only. First pleopod of first form male extremely long and slender, reaching cephalad to coxopodite of first pereopod; shoulder present on cephalic surface; central projection decidedly longer than mesial process, setiform and straight

almost to tip; mesial process slender and bent mesiad near tip.

Coloration: Body color is slate gray with chela slate gray dorsally. The uropods and telson are fuscus. Dorsolateral paired bright red spots occur on tergal segments three, four, and five while a red bar runs across tergal segment six. A light tinge of red occurs at the base of the telson. Cheeks and lower edge of gill cover have pinkish streaks. Ventrally, the body is colored off-white to light pink and the underside of the chela is off-white to brownish-orange on the fingers (Williams, 1954).

Size: Adults are about one to three inches in length.

Habitat: Hobbs (1989) presented the habitat of O. leptogonopodus as small clear rocky streams.

General Range: The general range of this crayfish is the Red River drainage of Arkansas and eastern Oklahoma in the Ouachita Mountain province (Hobbs, 1989).

Range Within Arkansas: This crayfish species is found in the Red River drainage (Little River system).

Localities Collected: 28, 29, 30, 31, 32, 43, 206, 218, 219, 220, 221, 229.

Comments: The type locality of this crayfish is McKinney's Creek, 4.7 miles northeast of Hatfield, Polk County, Arkansas on U. S. Hwy. 71 (Hobbs, 1948).

Orconectes leptogonopodus was collected only 12 times during the survey from its Little River drainage streams and rivers. These twelve collections produced 54 individuals. While locally abundant, it was rather uncommon overall on the ONF as it was

limited to the Little River drainage.

Orconectes menae (Creaser)

Map 6

Recognition Characters: Rostrum wide with blunt lateral spines; branchiostegal spine absent; areola open; antennal scale widest at a point anterior to mid-length; first pleopod terminating in two elongate processes; central projection longer and bent slightly caudad at distal end.

Coloration:

Size: Adults are about one to three inches in length.

Habitat: This species has been taken from under rocks in shallow, clear, flowing streams (Reimer, 1963). Williams (1954) reported it from burrows under rocks.

General Range: Orconectes menae is distributed throughout the tributaries of the Ouachita River in Polk and Montgomery counties, Arkansas, and in the Red River drainages of LeFlore and McCurtain counties, Oklahoma (Hobbs, 1989).

Range Within Arkansas: This species occurs in tributaries of the Ouachita River in Polk and Montgomery counties (Hobbs, 1989).

Localities Collected: 196, 205.

Comments: The type locality of this species is a stream tributary to the Irons Fork of the Ouachita River near Mena, Polk County, Arkansas.

Orconectes menae was taken only twice during the survey. Two specimens were collected from each of the two sites (total of

four specimens) and thus it is considered rare within the ONF. As an endemic of the upper Ouachita River its localized distribution was to be expected.

Orconectes palmeri (Faxon)

Map 6

Recognition Characters: Rostrum with lateral spines; areola obliterated; hooks on third pereopods of males; first pleopod of males terminating in two elongated processes, both bent caudad.

Coloration: Body color light grayish tan, thickly dusted with greenish-black specks. A pair of dark blotches is present on dorsum ahead of cervical groove and another pair of blotches extend across junction of carapace and abdomen. Fingers edged with orangish color with bluish color following.

Size: Adults are about 1.4 to 3.0 inches in length.

General Range: St. Francis River and all eastern tributaries of the Mississippi River between the Obion River and Thompson's Creek inclusive. Williams (1954) studied Orconectes palmeri and Orconectes palmeri longimanus in Arkansas. Penn (1957) reviewed subspeciation in this species and established definite ranges for all forms.

Range within Arkansas: The species, Orconectes palmeri generally occurs statewide, except in the extreme northwestern portion of the state in the upper White River system (Reimer, 1963). The form inhabiting the ONF, O. p. longimanus, occurs from the Arkansas River drainage southward.

Localities Collected: 4, 6, 7, 8, 10, 16, 18, 20, 21, 23, 24, 26, 27, 42, 57, 65, 68, 71, 80, 81, 82, 83, 84, 86, 87, 88, 89, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 108, 109, 110, 111, 112, 113, 114, 116, 117, 118, 119, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 157, 158, 159, 160, 161, 164, 193, 194, 195, 196, 197, 198, 199, 205, 209, 210, 211, 215, 216, 222, 223, 224, 225, 226, 228, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 243, 245, 249, 250.

Comments: The particular subspecies of this crayfish occurring on the ONF is Orconectes palmeri longimanus. This is the second most abundant crayfish inhabiting the ONF having been found at 115 of the 251 stations sampled. A total of 807 specimens of O. palmeri longimanus was collected during the study.

Orconectes sp. nov

Map 7

Recognition Characters: A plain brownish crayfish of medium size with a carapace shorter than the abdomen. Areola well-developed. Male gonopod terminating in two elongate, rather strongly curved processes; gonopod processes both curving in the same direction and widely separate near their tips.

Coloration: The basic body color is brownish-green. Chelae are brownish green also.

Size: Adults are about two to three inches in length.

Habitat: This crayfish inhabits pool margins of small, clear,

upland streams where it hides beneath bedrock, rubble, and rocks and wanders in search of food throughout shallow pool regions.

General Range: Arkansas endemic.

Range Within Arkansas: Known only from the upper Saline River basin and the upper Maumelle River basin.

Localities Collected: 242, 243, 244, 245, 246,

Comments: This undescribed species has been known for some time; however, the late Dr. Horton H. Hobbs, Jr. never officially described the crayfish. As part of an on-going study of the crayfishes of Arkansas, Dr. Raymond W. Bouchard of the Philadelphia Academy of Science and the Principal Investigator are in the process of writing a book which will resolve several longstanding taxonomic problems in Arkansas relating to crayfish systematics.

The undescribed species was collected five times from the upper Saline River drainage (Ouachita River system) and also from the upper Maumelle River drainage. A total of 67 specimens was collected by Mr. David Saugey and the Principal Investigator.

***Procambarus acutus* (Girard)**

Map 8

Recognition Characters: A large dark red or brown crayfish with a blackish, wedge-shaped pattern on the abdomen and long, slender pincers. Carapace laterally compressed, its sides with a granular texture resulting from many small buns or tubercles. Areola present, grooves separated at midpoint by a narrow space.

Rostrum with a trough-like central depression, its margins strongly converging anteriorly. Acumen short, the spines or tubercles separating it from remainder of rostrum small or absent.

Male gonopod with four short processes, three of which are strongly curved laterally from midline. Processes partly obscured by hairlike structures. Gonopod tips without a prominent shoulder. Hooks present on bases of second and third pairs of walking legs. Female sperm receptacle with fossa located to right of midline and overhung by the largest of three tubercles present on surface of receptacle (Pflieger, 1996).

Coloration: Adults typically are burgundy red with a black wedge-shaped pattern on the abdomen. Tubercles on sides of the body and pincers are cream-colored. Occasionally adults are brownish rather than red. Specimens taken from turbid water are often pale colored, almost tan in coloration. Juveniles are pale gray with blackish spots laterally on the carapace and do not have a blackish wedge on the abdomen.

Size: Adults are about three to five inches in length.

Habitat: Reimer (1963) reported that this crayfish had the greatest diversity of habitat of any Arkansas crayfish. Usually the species prefers lentic backwater habitats but occasionally may burrow at the margins of pools.

General Range: The general range of the nominate form, Procambarus acutus acutus, is from the Coastal Plain and piedmont from Maine to Georgia, from the Florida panhandle to Texas, and

from Minnesota to Ohio. This form intergrades with P. a. cuevachicae in southwestern Texas and northern Mexico.

Range Within Arkansas: Statewide.

Localities Collected: 42, 89, 91, 126, 132, 133, 139, 223.

Comments: This crayfish is one of Arkansas' most common statewide inhabitants. Hobbs (1989) remarked that, with little doubt, the populations currently assigned to this subspecies constitute a species complex.

Because of its propensity for lentic backwater habitats which are few in the swift Ouachita Mountain streams, Procambarus acutus is a rather uncommon inhabitant of the ONF. During the study 15 individuals of this species were taken from eight localities. Interestingly, just outside the ONF in Lake Greeson (Little Missouri drainage) Procambarus acutus is quite abundant as samples seined from a small farm pond owned by Mr. and Mrs. Clay Crump attested. Procambarus acutus were collected by Mrs. Betty Crump and kept for later inspection by the Principal Investigator.

Procambarus liberorum Fitzpatrick

Map 9

Recognition Characters: Rostrum with gently converging margins, lacking marginal spines; acumen nearly obsolete and poorly delineated from rostrum. Areola 39.3-41.5 (average 40.2) percent of entire length of carapace; areola linear. Carapace lacking cervical spines or tubercles. Suborbital angle broadly acute to

obsolete. Postorbital ridges terminating cephalically without spines or tubercles. Cephalic part of epistome rounded trapezoid, lacking cephalomedian tubercle. Antennal scale 2.05-2.67 (av. 2.31) times longer than broad, widest distal to midlength. thickened lateral part terminating cephalically in short, stout, subconical spine. Mesial margin of palm with row of 6-7 strong, spinose tubercles decreasing in size distally, two additional irregular rows of 5-6 and 3-5 more squamous tubercles medial to it. Dactyl with 2-5 small tubercles on basal fourth of mesial margin. Opposable margin of immovable finger with large tubercle in basal fourth, tiny tubercle in proximal part of gently excavated next half, and distal fourth with crowded minute denticles interrupted by small tubercle proximally. Opposable margin of dactyl deeply excavate in basal third with three small tubercles, two more tubercles on margin proximal to midlength, and distal half with band of crowded, minute denticles, broken by small tubercles near base. Ischia of third periopods only bearing hooks in males; no conspicuous prominences or bosses on coxae of periopods. Inner ramus of uropod lacking prominent spines projecting beyond distal margin. First pleopods symmetrical, strongly right-angled shoulder at base of central projection, pleopods reaching coxae of third periopods when abdomen flexed; distal extremity bearing (1) prominent, subacute, nearly setiform mesial process extending subparallel to main axis of pleopod and twice distance distally as other elements, and gently curved cephalad in distal half; (2)

well developed central projection terminating distally in acute angle directed slightly caudolaterally; (3) conspicuous subrectangular (in lateral aspect) caudal process laterally compressed distally, and extending distad just beyond central projection; and (4) prominent cephalic process placed cephalomesial to central projection, extending 90 percent of length of latter and running subparallel to main axis of pleopod.

Coloration: This medium-sized crayfish possess a purplish-red to brownish dorsum that is sharply delimited from a cream-to-buff ventrolateral section of the carapace (Hobbs and Robison, 1989). It does not possess any bold markings across the carapace or chelipeds.

Size: Adults are approximately three to five inches in length.

Habitat: This primary burrowing species lives in burrows in clay to sandy substrates in seepage areas and roadside ditches (Pflieger, 1996).

General Range: Endemic to Arkansas (Robison and Allen, 1995).

Range Within Arkansas: This species is a state endemic crayfish of the Arkansas River basin and occurs from Benton and Washington counties to Pope, Scott, and Yell counties in Arkansas (Hobbs and Robison, 1988).

Localities Collected: 1, 2, 3, 132.

Comments: Hobbs and Robison (1988) presented the distribution of this endemic crayfish in Arkansas as did Robison and Allen (1995).

Six specimens of the primary burrowing crayfish Procambarus

liberorum were collected during this study from four different sites, one in Scott County (Station 132) and three in Yell County (Stations 1-3). This wide-ranging species, while appearing rare on the ONF, is in no danger as its distributional range stretches from northern AR near Fayetteville to south of Waldron and eastward to almost Morrilton, AR.

***Procambarus ouachitae* Penn**

Map 10

Recognition Characters: *Procambarus ouachitae* is a tannish or brown crayfish with mottlings of black pigment. The rostrum has prominent lateral spines and usually has a well developed carina. The areola is broad and two lateral spines occur on each side of the cephalothorax. The first pleopod terminates in three parts. The mesial process extends caudodistad while the cephalic process is an angulate lobe. The mesial process and the cephalic process are more or less in apposition to each other.

Coloration: Adults typically have a tannish to brown body color with a black wedge-shaped pattern on the abdomen.

Size: Adults are approximately three to five inches in length.

Habitat: Reimer (1963) reported that this stream dwelling crayfish occurred primarily in creeks in which the water was clear and fairly shallow.

General Range: Hobbs (1989) presented the range of this species as the Ouachita and Arkansas river systems in southwestern Arkansas, and the Yazoo Basin in Mississippi.

Range in Arkansas: In Arkansas, Procambarus ouachitae inhabits streams of the Ouachita and Arkansas River systems in southwestern Arkansas (Hobbs, 1989).

Localities Collected: 244, 245.

Comments: Penn (1956) classified this species as a nocturnal species. He reported individuals of all sizes foraging at night in the relatively quiet water near the stream banks. First form males have been taken in May, June and August (Penn, 1956; Reimer, 1963).

The only two locations where Procambarus ouachitae was collected were in the Saline River drainage in Perry County. Four juvenile specimens were collected in August by Mr. David Saugey and the Principal Investigator from shallow pool areas.

Procambarus parasimulans Hobbs and Robison

Map 11

Recognition Characters: Rostrum without marginal spine and median carina. Carapace lacking cervical spine or tubercle. Areola averages 6.6 times as long as broad and constituting about 32.5 percent of total length of carapace. Branchiostegal spine reduced to weak tubercle. Ventral surface of chela strongly tuberculate, tubercles present along proximal half of ventral surface of dactyl. Ischium of third periopod of first form male with simple, strong hook overreaching basioischial articulation. Coxa on fourth periopod lacking caudomesial boss. First pleopods of first form males reaching coxae of third periopods,

symmetrical, bearing proximomesial spur at caudal proximomesial angle and subtruncate cephalic shoulder at base of terminal elements, lacking subbterminal setae; terminal elements consisting of (1) long slightly curved mesial process reaching beyond other elements; (2) small, weakly curved, cephalodistally directed cephalic process at cephalic base of mesial process, (3) similarly disposed, strongly cornified clawlike central projection arising from between mesial and caudal processes; and (4) very conspicuous caudal process rounded, spatulate, and disposed cephalodistally.

Coloration: Carapace pale tan dorsally fading to cream ventrolaterally. Dark brown stripe on ventral flank or postorbital ridge and another extending ventrally across orbital and antennal areas, setting off marginal, subtriangular cream marking on antennal and upper anteroventral branchiostegal regions. Abdomen-like carapace, tan dorsally fading ventrally to very pale tan and marked by two pairs of scalloped dark stripes, the more dorsal one darker and extending caudally. Dorsal surface of cheliped much darker than ventral, dark brown reticulations most conspicuous along dorsal edge and on distal border of merus.

Size: Adults are approximately four to five inches in length.

Habitat: This burrower is found in floodplain areas and occasionally wanders out into temporary pools and backwater pools of small streams.

General Range: An Arkansas endemic (Robison and Allen, 1995).

Range Within Arkansas: Southwestern part of Arkansas where it has been found in the Red and Ouachita River basins and three localities in the Arkansas River watershed (Hobbs and Robison, 1982; 1989).

Localities Collected: 186.

Comments: The type locality is an unnamed tributary of Prairie Creek 10.2 miles east of Bismark, Hot Spring County, on St. Hwy. 84 (Hobbs and Robison, 1988).

Although this species was not collected during the study, it has been collected a single time on the ONF from the site of Station 186. Previously, Dr. A. P. Blair of Tulsa University, while looking for paleback darters, collected one female P. parasimulans 0.9 mile west of Caddo Gap, Montgomery County, on 23 November 1962 (Hobbs and Robison, 1988). A visit to this site yielded no crayfishes. The species is also known to occur more commonly just south of the ONF near the communities of Kirby and Daisy.

Procambarus reimeri Hobbs

Map 13

Recognition Characters: Rostrum without marginal spines and median carina. Carapace lacking cervical spine or tubercle. Areola about 20.5 times as long as broad and constituting about 37.5 percent of total length of carapace. Postorbital ridge lacking cephalic spine or tubercle. Branchiostegal spine vestigial or absent. Ischium of third periopod of first form

male with simple hook overreaching basioschial articulation. first pleopods reaching coxae of third pereopods, symmetrical, bearing proximomesial spur and cephalic shoulder at base of terminal elements, lacking subterminal setae but with cephalomesial row of setae along distal third to half of appendage. Terminal elements consisting of (1) long, tapering, slightly curved mesial process extending distally beyond other terminals; (2) small acute slightly curved, but distally directed cephalic process at cephalic base of mesial process; (3) rather inconspicuous but composite central projection arising from between bases of cephalic, mesial and caudal processes, and closely associated with the latter; and (4) very prominent caudal process subacute and obscuring central projection in lateral aspect and somewhat rounded distally and flattened caudally in caudal aspect.

Coloration: Carapace coloration pinkish cream. Dorsolateral part of branchiostegites suffused with brown; posterior part of mandibular adductor region, areola, and posterodorsal region pinkish brown. First abdominal tergum dark brick red, second through fifth terga cherry, and sixth, together with all pleura, telson, and uropods, similarly colored but suffused with tan. Cheliped pinkish cream from base to proximal half or two-thirds of merus, where becoming olive tan or brown; chela olive mesially and dorsally, and pinkish orange ventrally and laterally.

Size: Adults are approximately three to five inches in length.

Habitat: This burrowing species was found in roadside ditches

and low wet seepage areas.

General Range: This is another Arkansas endemic crayfish found only in Polk County, Arkansas.

Range Within Arkansas: Confined to upper Irons Fork of Ouachita River in Polk County, Arkansas (Hobbs and Robison, 1988; Robison and Allen, 1995).

Localities Collected: 168, 169, 170, 171, 172, 173, 174, 175, 176, 177.

Comments: The type locality is burrows in roadside ditch about five miles northeast of Mena, Polk County, AR, on unnumbered road to Irons Fork River (Hobbs, 1979).

Procambarus reimeri is a local endemic of the upper Irons Fork of the Ouachita River drainage and a few areas around Mena, AR. Ten samples totalling 52 individuals of P. reimeri were collected. This total included numerous juvenile specimens which were released unharmed. Populations appear stable in the localized areas where it occurs, but it is confined to a rather small area within the ONF and should be carefully monitored in the future.

Procambarus tenuis Hobbs

Map 14

Recognition Characters: Rostrum without lateral spines; branchiostegal spines absent; areola narrow with only two punctations in narrowest part; cephalothorax strongly compressed and bearing prominent setiferous punctations between which are

crowded numerous smaller ones antennal scale widest anterior to midlength; males with hooks on ischiopodites on third and fourth pereopods; palm of chela of first form male not bearded but bearing a row of seven to nine tubercles along inner margin; first pleopod terminates in three processes; noncorneous mesial process thin, triangular and directed caudally at nearly a 90 degree angle with axis of shaft; cephalic process plate-like; corneous central projection most prominent of the three terminal elements.

Coloration: Basic body coloration light tan with blackish speckles.

Size: Adults are approximately three to five inches in length.

Habitat: This burrowing species has been collected from under rocks in clear cold streams, where it is apparently quite active even in very cold water (Williams, 1954). In this study P. tenuis was taken from a simple burrow from beneath rocks in a spring-fed runoff area.

General Range: The range of Procambarus tenuis is the Arkansas, Ouachita, and Red River basins of eastern Oklahoma and western Arkansas (Hobbs, 1989).

Range Within Arkansas: Within the state, this Ouachita Mountains endemic species inhabits limited areas of the upper Ouachita, upper Little River tributaries (Red River drainage), and Arkansas River basins of western Arkansas.

Localities Collected: 213, 214.

Comments: The type locality of this species is six miles (9.6

km) east of Page and just west of the Oklahoma state line, LeFlore County, Oklahoma (Hobbs, 1950).

Procambarus tenuis was collected only twice during the study, one specimen at the spring behind the Wonder House in Queen Wilhelmina State Park (Station 214) and a second specimen from a roadside seepage area, 9.5 miles northwest of Mena, Polk County (Station 213). It is a very rare crayfish within the ONF as only two specimens were taken in the two-year study.

CONSERVATION STATUS OF FOREST CRAYFISHES

Taylor, et al. (1996) recently published a comprehensive report of the conservation status of the crayfishes of the United States and Canada. This inclusive document provided by the American Fisheries Society (AFS) Endangered Species Committee is the first attempt to provide a conservation status for all 338 crayfish species occurring within the United States and Canada for use by resource managers, lawmakers, citizens, and aquatic biologists alike.

Regarding crayfish species inhabiting the Ouachita National Forest, Fallicambarus strawni and Orconectes menae were given a conservation status of "Threatened" while Procambarus reimeri was considered "Endangered." Orconectes acares, O. leptogonopodus, O. palmeri longimanus, Procambarus acutus, P. liberorum, P. ouachitae, P. parasimulans, and P. tenuis were designated a conservation status of "Special Concern" which is a species that may become endangered or threatened by relatively minor

disturbances to its habitat and deserves careful monitoring of its abundance and distribution.

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GLOSSARY

ABDOMEN. Region of the body posterior to cephalothorax, consisting of six body segments and telson.

ACUMEN. Pointed apical part (tip) of rostrum, frequently delineated basally by marginal spines.

ANNULUS VENTRALIS. Crayfish seminal receptacle, consisting of median sclerite between fourth and fifth pereopods; the spermatophore receptacle on sternum of female.

ANTENNA. Whiplike, generally long sensory organ arising from anterior region of cephalothorax.

ANTENNAL SCALE. Bladelike exopod of antenna situated at base of antenna.

ANTENNAL SPINE. Spine on, or adjacent to, anterior margin of carapace and ventral to orbit.

ANTENNULE. One of pair of appendages of first cephalic somite; "first antenna".

ANTERIOR. Front end of organism; "head end."

APICAL. Apex; tip.

AREOLA. Dorsomedial area (usually hourglass shaped) of thoracic region of carapace of crayfishes, bounded laterally by paired arched (branchiocardiac) grooves delineating dorsomedial limits of gill chamber.

BASIS. Second segment (from proximal end) of segmented appendage.

BOSS. An expanded portion (rounded protuberance) on mesial surface of coxa of fourth pereopod of male crayfishes.

BRANCHIOSTEGAL SPINE. Short spine situated on or near anterior margin of carapace, ventral to antennal spine in shrimps; in crayfishes, located immediately ventral to anterior extremity of cervical groove.

BURROWER. Crayfishes (usually all) that spend some or nearly all of their life history in confines of excavated burrow.

PRIMARY. Crayfishes that spend almost entire lives in subterranean galleries.

SECONDARY. Crayfishes that spend much of their lives in burrows but frequently move into open water during rainy seasons.

TERTIARY. Crayfishes that live in open water and retreat to burrows in response to several factors: a) to remain below frost line during winter, b) females enter as period of ovulation approaches and remain in burrows to lay and brood eggs, c) to find protective cover and to avoid dessication as water bodies disappear.

CARAPACE. "Shield" (exoskeleton) overlying cephalothoracic somites of body.

CARAPACE LENGTH. In shrimps, distance from posterior margin of orbit to midcaudodorsal margin of carapace; in crayfishes, distance from tip of rostrum to midcaudodorsal margin of carapace.

CARINA. Median middorsal ridge on rostrum; oriented parallel to lateral margins of rostrum.

CARPUS. Fifth segment from proximal end of segmented appendage.

CAUDAL. Posterior (rear, tail) end of organism.

CENTRAL PROJECTION. Terminal projection on crayfish male gonopod formed by fusion of two processes; poorly developed in second form male; located centrally on apex of Procambarus gonopod, distally on that of Cambarus, Fallicambarus, and Orconectes.

CEPHALIC. Pertaining to head; of head.

CEPHALOTHORAX. Portion of body bearing eyes and all appendages through fifth pereopod (fused head and thorax).

CERVICAL GROOVE. Major arclike suture (groove) on carapace of crayfish, dividing it into anterior (cephalic) and posterior (thoracic) regions.

CERVICAL SPINE. Spine on lateral surface of carapace immediately posterior to cervical groove of crayfishes.

CHELA. Forcepslike structure ("claw" or "pincer"), consisting of two opposed distal podomeres of first, second, and third pereopods of crayfishes, first and second pereopods of shrimps; dactyl (moveable finger) and propodus.

CHELIPED. Pereopod bearing chela, in crayfish literature applied almost exclusively to first pereopod.

CORNEOUS. Structures that are horny (sclerified), particularly as related to reproductive appendages (modified first pleopod) of first form males.

COXA. Proximal (first) segment of segmented appendage.

DACTYL. Distalmost segment of usually 7-segmented appendage; smaller, mesially situated, and moveable part of chela (moveable finger).

DISTAL. Away from body mid-line; toward apex (tips) of appendages.

DORSAL. Top or back of shrimp or crayfish.

EPIGEAN. Referring to above ground habitats as opposed to hypogean.

EPISTOME. Transverse plate (usually somewhat triangular in shape) situated ventrally and anterior to gnathal appendages of crayfishes.

EXOPOD. Lateral ramus of biramus appendage, originating on second segment (basis) from base.

EXOSKELETON. Outer covering of arthropods; "shell."

EXTENSOR SURFACE. Unopposed surface (face) of flexible podomere of an appendage (in opposition to opposed, flexor surface).

FINGER. One of two rami of chela; movable finger (dactyl) and immovable finger of opposable part of propodus.

FIRST FORM MALE. Sexually functional male crayfish (Cambaridae); at least one terminal element of first pleopod usually corneous.

GONOPOD. Pleopod in male modified for reproductive purposes.

HEPATIC AREA. Paired cephalolateral region to either side of carapace between orbit and cervical groove (in crayfishes).

HEPATIC SPINE. Spine situated near anterior margin of hepatic area of carapace of certain shrimps, or on hepatic area of cambarids.

HYPOGEAN. Subterranean; referring to beneath surface of earth; burrow or cave environment.

HYPORHEIC ZONE. Interstices formed in substrate of streams (between coarse sand, gravel, and cobble).

INCISOR PROCESS. Cutting surface (lobe) of mandible (as opposed to molar or grinding lobe).

ISCHIOPODITE. Third segment from base of a segmented appendage.

ISCHIUM. See ischiopodite.

LATERAL. Referring to or toward side.

MANDIBLE. most anterodorsally situated of gnathal appendages; one, of a pair, of heavily calcified jaws; the "teeth."

MAXILLA. One of a pair of two sets of gnathal appendages situated immediately posteroventral to mandibles.

MAXILLIPED. One of pair of three sets of gnathal appendages lying immediately posterior to second pair of maxillae.

MERUS. Fourth segment from proximal end of segmented appendage.

MESIAL. Referring to or toward middle.

MESIAL PROCESS. Terminal process located mesially on modified first pleopod (gonopod) of male cambarid crayfishes.

MOVABLE FINGER. (=dactyl); distalmost podomere of segmented appendage.

PALM. Expanded portion of propodus of chela situated proximal to "fingers".

PEREIOPOD (PEREOPOD). One of five pairs of appendages (legs) supporting cephalothorax; walking and chelate legs.

PLEOPOD. One of five pairs of appendages on first five abdominal

segments ("swimmerets," or modified into male gonopod).

PLEURON. Lateral overhanging plate of abdominal segments.

PODOMERE. Single segment of any appendage.

POSTANNULAR PLATE. Medially situated sclerite (plate) immediately posterior to annulus ventralis.

POSTERIOR. Toward caudal or "hind" end.

POSTORBITAL CARAPACE LENGTH. Distance from orbit to mid-caudodorsal (posterior) margin of carapace.

PROPODUS. Penultimate segment (sixth from base) of segmented appendage.

PROXIMAL. Toward the body; that portion of appendage nearest body.

PUNCTATION. Small depression (pit).

ROSTRUM. Dorsomedian anterior projection of cephalothorax, in crayfishes partly covering eyestalks and bases of antennae and antennules.

SECOND MALE FORM. One of two morphological forms of male cambarids; sexually nonfunctional male (II) lacking corneous terminal element on first pleopod (gonopod).

STERNUM. Midventral platelike surface of body, situated between coxae of appendages.

TELSON. Terminal (posterior) portion of abdomen; caudomedian element of "tail fan".

TUBERCLE. Low protuberance on exoskeleton.

UROPOD. Paired biramous appendage on sixth abdominal segment, lateral parts of "tail fan".

VENTRAL. On or toward underside.

TABLE 1. Collecting Localities of Crayfishes in the Ouachita National Forest, Arkansas.

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1. Perry Co.: Roadside ditch 2 mi. S. of Hollis, AR on St. Hwy. 7 (Sec. 35, T3N, R20W). 14 April 1996. Henry W. Robison.
 2. Yell Co.: Roadside seepage 27 mi. S of Rover, AR on St. Hwy. 27 (Sec. 36, T3N, R23W). 14 April 1996. Henry W. Robison.
 3. Yell Co.: Roadside ditch 0.5 mi. N. of Onyx, AR on St. Hwy. 27 (Sec. 1, T2N, R23W). 14 April 1996. Henry W. Robison.
 4. Yell Co.: Irons Fork of Ouachita River at St. Hwy. 27 (Sec. 6, T1N, R23W). 14 April 1996. Henry W. Robison.
 5. Montgomery Co.: Collier Creek at St. Hwy. 8, N. of Caddo Gap, AR (Sec. 12, T4S, R25W). 14 April 1996. Henry W. Robison.
 6. Montgomery Co.: Caddo River at St. Hwy. 240, SE of Caddo Gap, AR (Sec. 13, T4S, R24W). 14 April 1996. Henry W. Robison.
 7. Montgomery Co.: Little Missouri River at Camp Albert Pike Rec. Area, 6 mi. NW of Langley, AR (Sec. 27, T4S, R27W). 26 April 1996. Henry W. Robison.
 8. Pike Co.: Little Missouri River, 4 mi. W. of Langley, AR at St. Hwy. 84 (Sec. 16, T5S, R27W). 26 April 1996. Henry W. Robison.
 9. Montgomery Co.: Caddo River at Caddo Gap, AR (Sec. 13, T4S, R24W). 26 April 1996. Henry W. Robison.
 10. Montgomery Co.: Caddo River at Norman, AR (Sec. 28, T3S,

R25W). 26 April 1996. Henry W. Robison.

11. Montgomery Co.: Crystal Springs Rec. area., 4 mi. NE of Norman, AR (Sec. 14, T3S, R25W). 26 April 1996. Henry W. Robison.
12. Montgomery Co.: Collier Springs (Sec. 17, T3S, R24W). 26 April 1996. Henry W. Robison.
13. Montgomery Co.: Twin Creek at U. S. Hwy. 270, ca. 6 mi. east of Mt. Ida, AR. (Sec. 25, R24W, T2S). 27 April 1996. Henry W. Robison.
14. Montgomery Co.: Williams Creek at U. S. Hwy. 270, ca. 1 mi. east Mt. Ida, AR (Sec. 30, T2S, R24W). 27 April 1996. Henry W. Robison.
15. Montgomery Co.: Rodgers Creek at U. S. Hwy 270, ca. 2 mi. east of Mt. Ida, AR (Sec. 29, T2S, R24W). 27 April 1996. Henry W. Robison.
16. Montgomery Co.: Shady Creek at U. S. Hwy. 270 east of Mt. Ida, AR (Sec. 26. T2S, R24W). 27 April 1996. Henry W. Robison.
17. Montgomery Co.: Murphy Creek at U. S. Hwy. 270 ca. 2.5 mi. east of Joplin, AR (Sec. 36, T2S, R23W). 27 April 1996. Henry W. Robison.
18. Montgomery Co.: Ouachita River, 6 mi. NW of Mt. Ida, AR at U. S. Hwy. 270 at Rocky Shoals (Sec. 32, T1S, R25W). 27 April 1996. Henry W. Robison.
19. Montgomery Co.: Little Brushy Creek, 1/2 mile E. of Oden, AR. on St. Hwy. 88 (Sec. 34, T1S, R26W). 27 April 1996.

Henry W. Robison.

20. Montgomery Co.: Ouachita River at Oden at St. Hwy. 379
(Sec. 32, T1S, R26W). 27 April 1996. Henry W. Robison.
21. Montgomery Co.: Ouachita River at Pine Ridge (Sec. 9, T2S,
R27W). 27 April 1996. Henry W. Robison.
22. Montgomery Co.: Bolan Creek at St. Hwy. 88, 1 mi. west of
Pine Ridge, AR (Sec. 7, T2S, R27W). 27 April 1996. Henry W.
Robison.
23. Polk Co.: Ouachita River , 0.5 mi. S. of Cherry Hill, AR
(Sec. 16, T2S, R28W). 27 April 1996. Henry W. Robison.
24. Polk Co.: Ouachita River at McGuire Access area (Sec. 23,
T2S, R29W). 27 April 1996. Henry W. Robison.
25. Polk Co.: Polk Creek at St. Hwy. 88, ca. 2 mi. west of
Cherry Hill, AR (Sec. 7, T2S, R28W). 27 April 1996. Henry W.
Robison.
26. Polk Co.: Iron's Fork of Ouachita River at St. Hwy. 88, 5.7
mi. E. of Mena, AR (Sec. 7, T2S, R27W). 28 April 1996.
Henry W. Robison.
27. Polk Co.: Ouachita River at U. S. Hwy. 71 at Acorn, AR
(Sec. 21, T2S, R30W). 28 April 1996. Henry W. Robison.
28. Polk Co.: Cossatot River at Shady, AR. (Sec. 32, T3S, R29W).
28 April 1996. Henry W. Robison.
29. Polk Co. Cossatot River, 2 mi. S. of Shady, AR on FRS road.
(Sec. 6, T4S, R29W). 28 April 1996. Henry W. Robison.
30. Polk Co.: Mine Creek ca. 1.5 mi. E. of Shady, AR. (Sec. 33,
T3S, R29W). 28 April 1996. Henry W. Robison.

31. Howard Co.: Cossatot River at St. Hwy. 246 bridge (Secs. 29 and 30, T4S, R30W)). 28 April 1996. Henry W. Robison.
32. Howard Co.: Cossatot River at FSR 31 Rd. (Sec. 21 and 22, T4S, R30W). 28 April 1996. Henry W. Robison.
33. Montgomery Co.: Tea Springs (Sec. 23, T3S, R23W). 21 May 1996. H. W. Robison.
34. Montgomery Co.: Blue Spring (Sec. 15, T3S, R23W). 21 May 1996. Henry W. Robison.
35. Montgomery Co.: Singing Springs (Sec. 16, 21, and 22, T3S, R24W). 21 May 1996. Henry W. Robison.
36. Montgomery Co.: Rattlesnake Spring (Sec. 33, T3S, R24W). 21 May 1996. Henry W. Robison.
37. Montgomery Co.: Collier Creek Spring (Sec. 17, T3S, R24W). 21 May 1996. Henry W. Robison.
38. Montgomery Co.: Box Springs (Sec. 33, T3S, R26W). 22 May 1996. Henry W. Robison.
39. Montgomery Co.: Slatington Spring (Sec. 33, T3S, R27W). 22 May 1996. Henry W. Robison.
40. Montgomery Co.: Crooked Creek Spring (Sec. 4, T4S, R27W). 22 May 1996. Henry W. Robison.
41. Polk Co.: Big Fork Creek at Big Fork, AR at St. Hwy. 8 (Sec. 15, T3S, R28W). 17 June 1996. Henry W. Robison.
42. Polk Co.: Shady Lake (Sec 31, T4S, R28W). 17 June 1996. Henry W. Robison.
43. Polk Co.: Saline River above Shady Lake (Sec. 30, T4S, R28W). 17 June 1996. Henry W. Robison.

44. Polk Co.: Kates Creek at Co. Rd. 23, ca. 4 mi. NE of Big Fork, AR. (Sec. 5, T3S, R27W). 17 June 1996. Henry W. Robison.
45. Polk Co. Big Fork Creek, 1/2 mi. south of Opal on Co. Rd. 67 (Sec. 3, T3S, R28W). 17 June 1996. Henry W. Robison.
46. Montgomery Co.: Rough Creek Seeps (Sec. 26, TT3S, R24W)). 21 June 1996. Henry W. Robison and Chris Carlton.
47. Montgomery Co.: Blue Springs (Sec. 15, T3S, R23W). 21 June 1996. Henry W. Robison and Chris Carlton.
48. Montgomery Co.: Box Springs (Sec. 33, T3S, R26W). 21 June 1996. Henry W. Robison and Chris Carlton.
49. Montgomery Co.: Slatington Springs (Sec. 33, T3S, R27W). 21 June 1996. Henry W. Robison and Chris Carlton.
49. Montgomery Co.: Singing Springs (Sec. 16, 21, and 22, T3S, R24W). 21 June 1996. Henry W. Robison.
50. Montgomery Co.: Wehunt Springs (Sec. 28, T3S, R27W). 21 June 1996. Henry W. Robison.
51. Montgomery Co.: Crooked Creek Springs (Sec. 4, T4S, R27W). 21 June 1996. Henry W. Robison.
52. Montgomery Co.: Rattlesnake Springs (Sec. 33, T3S, R24W). 22 June 1996. Henry W. Robison.
53. Montgomery Co.: Rattlesnake Creek Seeps (w/waterfall area) (Sec. 33, T3S, R24W). 22 June 1996. Henry W. Robison.
54. Montgomery Co.: Crystal Springs (Sec. 14, T3S, R25W). 22 June 1996. Henry W. Robison.
55. Montgomery Co.: Collier Springs (Sec. 17, T3S, R24W).

- 22 June 1996. Henry W. Robison.
56. Montgomery Co.: Polk Creek Springs (Sec. 5, T4S, R26W). 23 June 1996. Henry W. Robison.
57. Montgomery Co.: Little Missouri River at Albert Pike (Sec. 22 T4S, R27W). 23 June 1996. Henry W. Robison.
58. Montgomery Co.: Albert Pike seeps (Sec. 22, T4S, R27W). 23 June 1996. Henry W. Robison.
59. Polk Co.: Bard Springs (Sec. 20, T3S, R28W). 23 June 1996. Henry W. Robison.
60. Polk Co.: Big Fork Creek at St. Hwy. 8 (Sec. 23, T3S, R28W). 23 June 1996. Henry W. Robison.
61. Polk Co.: Abernathy Springs at St. Hwy. 8 (Sec. 24, T3S, R28W). 23 June 1996. Henry W. Robison.
62. Polk Co.: Big Fork Creek at St. Hwy. 8 at Abernathy Springs (Sec. 24, T3S, R28W). 23 June 1996. Henry W. Robison.
63. Montgomery Co.: Caddo River at St. Hwy. 8 (above Mr. Willie's) ca. 10 mi. west of Black Springs, AR (Sec. 29, T3S, R27W). 23 June 1996. Henry W. Robison.
64. Montgomery Co.: Caddo River at Mr. Willie's farm at St. Hwy. 8, ca. 8 mi. west of Black Springs, AR (Sec. 26, T3S, R27W). 23 June 1996. Henry W. Robison.
65. Montgomery Co.: Caddo River at St. Hwy. 8 (near Box Springs), ca. 6 mi. west of Black Springs, AR (Sec. 28, T3S, R26W). 23 June 1996. Henry W. Robison.
66. Montgomery Co.: Caddo River, south of Black Springs, AR (Sec. 28, T3S, R25W). 23 June 1996. Henry W. Robison.

67. Montgomery Co. Lick Creek, ca. 1 mi. N. of Black Springs, AR (Sec. 29, T3S, R25W). 23 June 1996. Henry W. Robison.
68. Montgomery Co.: Caddo River at St. Hwy. 240 (Sec. 13, T4S, R25W). 10 July 1996. Henry W. Robison.
69. Montgomery Co.: South Fork of Caddo River at Co. Rd. 4 (Sec. 13, T4S, R22W). 10 July 1996. Henry W. Robison.
70. Montgomery Co.: South Fork of Caddo River at Fancy Hill, AR. (Sec. 27, T4S, R26W). 10 July 1996. Henry W. Robison.
71. Montgomery Co.: South Fork of Caddo River south of Hopper, AR. at Co. rd. 5 (Sec. 33, T4S, R25W). 10 July 1996. Henry W. Robison.
72. Montgomery Co.: South Fork of Caddo River at Co. Rd. 4 (Sec. 20, T4S, R26W). 10 July 1996. Henry W. Robison.
73. Montgomery Co.: Smith Creek at St. Hwy. 8, ca. 0.5 mi. NW of Caddo Gap, AR (Sec. 12, T4S, R25W). 10 July 1996. Henry W. Robison.
74. Montgomery Co.: Gap Creek just north of jct. of Jones Creek at St. Hwy. 8, ca. 1 mi. south of Caddo Gap, AR (Sec. 12, T4S, R25W). 10 July 1996. Henry W. Robison.
75. Montgomery Co.: Mill Creek at Co. Rd. 9 (Sec. 9, T4S, R25W). 10 July 1996. Henry W. Robison.
76. Montgomery Co.: Collier Creek at St. Hwy. 8 at Caddo Hills High School (Sec. 12, T4S, R25W). 10 July 1996. Henry W. Robison.
77. Montgomery Co.: Huddleston Creek at St. Hwy. 8 at Norman, AR (Sec. 28, T3S, R25W). 01 July 1996. Henry W. Robison.

78. Montgomery Co.: Crystal Springs Recreational Area (Sec. 17, T3S, R24W). 10 July 1996. Henry W. Robison.
79. Montgomery Co.: Collier Creek at Collier Springs Recreational Area (Sec. 17, T3S, R24W). 10 July 1996. Henry W. Robison.
80. Montgomery Co.: South Fork of Ouachita River at U. S. Hwy. 270 at Mt. Ida, AR (Sec. 23, T2S, R25W). 11 July 1996. Henry W. Robison.
81. Montgomery Co.: Ouachita River at U. S. 270 bridge at Rocky Shoals (Sec. 32, T1S, R25W). 11 July 1996.
82. Montgomery Co.: South Fork of Ouachita River at St. Hwy. 379 (Sec. 19, T2S, R25W). 11 July 1996. Henry W. Robison.
83. Montgomery Co.: South Fork of Ouachita River at St. Hwy. 379 (Sec. 20, T2S, R25W). 11 July 1996. Henry W. Robison.
84. Montgomery Co.: South Fork of Ouachita River at FSR (Sec. 23, T2S, R26W). 11 July 1996. Henry W. Robison.
85. Montgomery Co.: Roadside ditch at west side of St. Hwy. 27, 3 mi. N. of Story, AR (Sec. 14, T1N, R24W). 11 July 1996. Henry W. Robison.
86. Montgomery Co.: Muddy Creek at St. Hwy. 27, N. of Story, AR (Sec. 13, T1N, R24W). 11 July 1996. Henry W. Robison.
87. Yell Co.: Irons Fork Creek at St. Hwy. 27 (Sec. 6, T1N, R23W). 11 July 1996. Henry W. Robison.
88. Yell Co.: Robertson Creek at St. Hwy. 27, N. of Aly, AR (Sec. 29, T2N, R23W). 11 July 1996. Henry W. Robison.
89. Yell Co.: South Fourche la Fave River at St. Hwy. 27 at Onyx, AR (Sec. 1, T2S, R23W). 11 July 1996. Henry W.

Robison.

90. Yell Co.: Roadside seepage at St. Hwy. 27, S. of Rover, AR (Sec. 14, T1N, R24W). 11 July 1996. Henry W. Robison.
91. Yell Co.: Fourche la Fave River at St. Hwy. 27, S. of Rover, AR (Sec. 12, T3S, R23W). 11 July 1996. Henry W. Robison.
92. Yell Co.: Dutch Creek at Co. Rd. 28, ca. 2 mi. northeast of Blue Ball, AR (Sec. 29, T4N, R25W). 5 July 1996. Henry W. Robison.
93. Yell Co.: Dutch Creek at St. Hwy. 80, 1/2 mi. west of Blue Ball, AR (Sec. 36, T4N, R26W). 5 July 1996. H. W. Robison.
94. Yell Co.: Dutch Creek at FSR S93B, 2 mi. west of Olio, AR (Sec. 19, T3N, R24W). 5 July 1996. H. W. Robison
95. Yell Co.: Brush Creek at Co. Rd. 17, 2 mi. West of Harvey, AR (Sec. 12, T3N, R24W). 5 July 1996. H. W. Robison.
96. Yell Co.: Big Cedar Creek at St. Hwy. 28 (Sec. 36, T2N, R27W). 5 July 1996. H. W. Robison.
97. Yell Co.: Gaffords Creek at FSR 7764, ca. 4 mi. SW of Bluffton, AR (Sec. 12, T2N, R25W). 5 July 1996. H. W. Robison.
98. Scott Co.: Poteau River at St. Hwy. 248, ca. 7 mi. east of Waldron, AR (Sec. 12, T3N, R28W). 5 July 1996. H. W. Robison.
99. Scott Co.: Poteau River at Hwy. 248 (Sec. 10, T3N, R28W), ca. 8 mi. east of Waldron, AR. 5 July 1996. H. W. Robison.
100. Scott Co.: Petit Jean River off Co. rd. 90 (Sec. 15, T4N, R29W). 5 July 1996. H. W. Robison.

101. Montgomery Co.: Singing Springs (Sec. 16, 21 and 22, T3S, R24W). 19 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
102. Montgomery Co.: Rattlesnake Springs (Sec. 33, T3S, R24W). 19 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
103. Montgomery Co.: Box Springs (Sec. 33, T3S, R26W). 19 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
104. Montgomery Co.: Blue Springs (Sec. 15, T3S, R23W). 19 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
105. Montgomery Co.: Collier Springs (Sec. 17, T3S, R24W). 20 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
106. Montgomery Co.: Slatington Springs (Sec. 33, T3S, R27W). 20 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
107. Montgomery Co.: Crooked Creek Springs/Seep (Sec. 4, T4S, R27W). 20 July 1996. Henry W. Robison, Nick Covington, and Ken Ball.
108. Montgomery Co.: Ouachita River at Pine Ridge (Sec. 9, T2S, R27W). 23 July 1996. Henry W. Robison and Taxonomy class.
109. Garland Co.: Mazarn Creek at FSR, 3 mi. N. of Bonnerdale, AR (Sec. 5, T4S, R22W). 2 August 1996. H. W. Robison.
110. Garland Co.: Mazarn Creek at Co. Rd. 104 north of Percy, AR (Sec. 25, T3S, R22W). 2 August 1996. H. W. Robison.
111. Garland Co.: Mazarn Creek at Co. Rd. 107, south of Sunshine, AR (Sec. 15, T3S, R21W). 2 August 1996. H. W.

Robison.

112. Garland Co.: Cearly Creek at St. Hwy. 227 (Sec. 8, T3S, R21W). 2 August 1996. H. W. Robison.
113. Garland Co.: Meyers Creek at Co. Rd. 103 (Sec. 21, T3S, R22W). 2 August 1996. H. W. Robison.
114. Polk Co.: Little Missouri River off Co. Rd. 25 (Sec. 3, T4S, R28W). 3 August 1996. H. W. Robison.
115. Montgomery Co.: Little Missouri River at Little Missouri Falls Rec. Area (Sec. 6, T4S, R27W). 3 August 1996.
H. W. Robison.
116. Montgomery Co.: Little Missouri River at FSR 22 (Sec. 22, T4S, R27W). 3 August 1996. H. W. Robison.
117. Montgomery Co.: Ouachita River at Pine Ridge (Sec. 9, T2S, R27W). 4 October 1996. Henry W. Robison and Vertebrate Natural History Class.
118. Montgomery Co.: Ouachita River at Oden, AR (Sec. 33, T1S, R26W). 4 October 1996. Henry W. Robison and Vertebrate Natural History Class.
119. Montgomery Co.: Ouachita River at McGuire Access Area (Sec. 23, T2S, R29W). 4 October 1996. Henry W. Robison and Vertebrate Natural History Class.
120. Montgomery Co.: Box Springs (Sec. 33, T3S, R26W).
17 October 1996. Henry W. Robison.
121. Montgomery Co.: Rattlesnake Springs (Sec. 33, T3S, R24W).
17 October 1996. Henry W. Robison.
122. Montgomery Co.: Blue Springs (Sec. 15, T3S, R23W).

- 17 October 1996. Henry W. Robison.
123. Montgomery Co.: Tea Springs (Sec. 23, R23W, T3S). 17 October 1996. Henry W. Robison.
124. Montgomery Co.: Collier Springs at Collier Springs Rec. Area (Sec. 17, T3S, R24W). 17 October 1996. Henry W. Robison.
125. Montgomery Co.: Singing Springs (Sec. 16, 21, and 22, T3S, R24W). 17 October 1996. Henry W. Robison.
126. Scott Co.: Petit Jean River at St. Hwy. 23, ca. 7 mi. SE of Mansfield, AR. (Sec. 7, T4N, R29W). 23 Feb. 1997. H. W. Robison.
127. Logan Co.: Jack Creek at Jack Creek Rec. Area on Sugar Creek (Sec. 2, T4N, R27W). 23 Feb. 1997. H. W. Robison.
128. Logan Co.: Knoppers Ford Rec. Area (Sec, 10, T4N, R27W). 23 Feb. 1997. H. W. Robison.
129. Logan Co.: Sugar Creek at FSR, 2 mi. SE of Jacks Creek Rec Area (Sec. , 23 Feb. 1997. H. W. Robison.
130. Logan Co.: Dry Creek at FSR (Sec. 1, T4N, R26W). 23 feb. 1997. H. W. Robison.
131. Scott Co.: Square Rock Creek at U.S. Hwy. 71. (Sec. 32, T4N, R29W). 23 Feb. 1997. H. W. Robison.
132. Scott Co.: Poteau River at U. S. Hwy. 71 (Sec. 17, T3N, R29W). 23 Feb. 1997. H. W. Robison.
133. Scott Co.: Fourche la Fave River, 1.2 mi. SE of Boles, AR (Sec. 1, T1N, R29W). 24 Feb. 1997. H. W. Robison.
133. Scott Co.: Honey Creek at Co. Rd. 18, 1 mi. Sw of Parks, AR

- (Sec. 33, T2N, R28W). 24 Feb. 1997. H. W. Robison.
134. Scott Co.: Robertson Creek at Co. Rd. 19, ca. 2 mi. SE of Parks, AR (Sec. 35, T2N, R28W). 24 Feb. 1997. H. W. Robison.
135. Scott Co.: Boston Creek at FSR 740, ca. 3 mi. SE of Parks, AR (Sec. 31, T2N, R27W). 24 Feb. 1997. H. W. Robison.
136. Scott Co.: Fourche la Fave River, S. of Parks (Sec. 27, T2N, R28W). 24 Feb. 1997. H. W. Robison.
137. Scott Co.: Brush Creek at St. Hwy. 28 (Sec. 8, T2N, R26W). 24 Feb. 1997. H. W. Robison.
138. Scott Co.: Twomile Creek at St. Hwy. 28, ca. 2 mi. of Bates, AR (Sec. 24, T3N, R32W). 24 Feb. 1997. H. W. Robison.
139. Scott Co.: Fourche la Fave River at U. S. Hwy. 71, 2 mi. SW of Boles, AR (Sec. 10, T1N, R29W). 24 Feb. 1997. H. W. Robison.
140. Scott Co.: Mill Creek at U. S. Hwy. 71 at Y-City (Sec. 21, T1N, R29W). 24 Feb. 1997. H. W. Robison.
141. Scott Co.: Rough Creek at U. S. Hwy. 71 (Sec. 20, T1N, R29W). 24 Feb. 1997. H. W. Robison.
142. Scott Co.: Steep Hollow Creek at U. S. Hwy. 270, 1 mi. E. of Y-City (Sec. 22, T1N, R29W). 1 March 1997. H. W. Robison.
143. Scott Co.: Unnamed Creek at U. S. Hwy. 270 (Sec. 23, T1N, R29W). 1 March 1997. H. W. Robison.
144. Scott Co.: Unnamed trib. to Mill Creek at U. S. Hwy. 270

- (Sec. 19, T1N, R28W). 1 March 1997. H. W. Robison.
145. Scott Co.: Unnamed trib to Mill Creek at U. S. Hwy. 270
(Sec. 20, T1N, R28W). 1 March 1997. H. W. Robison.
146. Scott Co.: Unnamed trib to Mill Creek at U. S. Hwy. 270
(Sec. 20, T1N, R28W). 1 March 1997. H. W. Robison.
147. Scott Co.: Turner Creek at U. S. Hwy. 270 (Sec. 21, T1N,
R28W). 1 March 1997. H. W. Robison.
148. Scott Co.: Spring Branch Creek at U. S. Hwy. 270 (Sec. 22,
T1N, R28W). 1 March 1997. H. W. Robison.
149. Scott Co.: Rock Creek at U. S. Hwy. 270 (Sec. 23, T1N,
R28W). 1 March 1997. H. W. Robison.
150. Scott Co.: Unnamed trib to Mill Creek at U.S. Hwy. 270
(Sec. 25, T1N, R28W). 1 March 1997. H. W. Robison.
151. Scott Co.: Mill Creek at U. S. Hwy. 270 (Sec. 31, T1N,
R27W). 1 March 1997. H. W. Robison.
152. Montgomery Co.: Unnamed trib of Sweetwater Creek at U. S.
Hwy. 270 (Sec. 3, T1S, R27W). 2 March 1997. H. W. Robison.
153. Montgomery Co.: Sweetwater Creek at U. S. Hwy. 270 (Sec. 2,
T1S, R27W). 2 March 1997. H. W. Robison.
154. Montgomery Co.: Brushy Creek at U. S. Hwy. 270 (Sec. 1,
T1S, R27W). 2 March 1997. H. W. Robison.
155. Montgomery Co.: Big Brushy Creek at U. S. Hwy. 270 (Sec. 6,
T1S, R26W). 2 March 1997. H. W. Robison.
156. Montgomery Co.: Fiddlers Creek at U. S. Hwy. 270 (Sec. 5,
T1N, R26W). 2 March 1997. H. W. Robison.
157. Montgomery Co.: Polk Creek at U. S. Hwy. 270, ca. 2 mi. NW

- of Pencil Bluff, AR (Sec. 15, T1S, R26W). 2 March 1997. H. W. Robison.
158. Montgomery Co.: Ouachita River at U. S. Hwy. 270 (Sec. 32, T1S, R25W). 2 March 1997. H. W. Robison.
159. Montgomery Co.: South Fork of Ouachita River at St. Hwy. 379 (Sec. 20, T2S, R25W). 2 March 1997. H. W. Robison.
160. Montgomery Co.: South Fork of Ouachita River at St. Hwy. 379 (Sec. 19, T1S, R25W). 2 March 1997. H. W. Robison.
161. Montgomery Co.: South Fork of Ouachita River at Co. Rd. 17 (Sec. 23, T2S, R26W). 2 March 1997. H. W. Robison.
162. Montgomery Co.: Collier Creek at St. Hwy. 8 (Sec. 12, T4S, R25W). 2 March 1997. H. W. Robison.
163. Montgomery Co.: Smith Creek at St. Hwy. 8 (Sec. 12, T4S, R25W). 2 March 1997. H. W. Robison.
164. Montgomery Co.: Caddo River at Caddo Gap, AR (Sec. 13, T4S, R25W). 2 March 1997. H. W. Robison.
165. Montgomery Co.: Gap Creek at St. Hwy. 8, 1 mi. SE of Caddo Gap, AR (Sec. 18, T4S, R24W). 2 March 1997. H. W. Robison.
166. Montgomery Co.: Unnamed trib to Fivemile Creek at St. Hwy. 8 (Sec. 28, T4S, R24W). 2 March 1997. H. W. Robison.
167. Polk Co.: Big Fork Creek at St. Hwy. 8 at Abernathy Springs (Sec. 24, T3S, R28W). 11 April 1997. Henry W. Robison.
168. Polk Co.: Roadside ditch, 1.2 mi. E. of U. S. Hwy. 71 on Posey Hollow Road (=Road to Iron's Fork Lake) at junction with Co. Rd. 635 (Sec. 18, T1S, R29W). 12 April 1997.

Henry W. Robison.

169. Polk Co.: Gap Creek at Posey Hollow Road, 1.3 mi. E. of Posey Hollow Road and U. S. Hwy. 71 (Sec. 18 and 19, T1S, R29W). 12 April 1997. Henry W. Robison.
170. Polk Co.: Roadside ditch (on north side of road), 1.4 mi. E. of jct. of Posey Hollow Road and U. S. Hwy. 71 (Sec. 18, T1S, R29W). 12 April 1997. Henry W. Robison.
171. Polk Co.: Unnamed tributary of Gap Creek, 1.5 mi. E. of Posey Hollow Road and U. S. Hwy. 71 on Posey Hollow Road (Sec. 18, T1S, R29W). 12 April 1997. Henry W. Robison.
172. Polk Co.: Roadside ditch, 1.7 mi. E. of jct. of Posey Hollow Road and U. S. Hwy. 71 on Posey Hollow Road (Sec. 17, T1S, R29W). 12 April 1997. Henry W. Robison.
173. Polk Co.: Roadside seepage at Iron's Fork Lake (Sec. 21, T1S, R29W). 12 April 1997. Henry W. Robison.
174. Polk Co.: Roadside standing water next to the gravel road leading to Iron's Fork Lake (Sec. 21, T1S, R29W). 12 April 1997. Henry W. Robison.
175. Polk Co.: Ouachita River at Co. Rd. 74 at steel bridge (Sec. 2, T2S, R30W). 12 April 1997. Henry W. Robison.
176. Polk Co.: Roadside ditch at side of St. Hwy. 88, 3.4 mi. E. of junction of St. Hwy. 88 and U. S. Hwy. 71 (Sec. 13, T2S, R30W). 12 April 1997.
177. Polk Co.: Roadside ditch and runoff, 0.4 mi. North on U.S. Hwy. 71 from junction of U. S. Hwy. 71 and Posey Hollow Road; 100 yards south of Treasure Lane (Sec. 13, T1S, R30W).

- 12 April 1997. Henry W. Robison.
178. Polk Co.: Wheeler Creek at St. Hwy. 8, west of Mena, AR (Sec. 30, T1S, R32W). 13 April 1997. Henry W. Robison.
179. Polk Co.: Collins Creek at St. Hwy. 8 west of Mena, AR (Sec. 28, T1S, R32W). 13 April 1997. Henry W. Robison.
180. Polk Co.: Mill Creek at St. Hwy. 8 (Sec. 3, T2S, R32W). 13 April 1997. Henry W. Robison.
181. Polk Co.: Rock Creek northwest of Mena, AR at St. Hwy. 8 (Sec. 34, T2S, R31W). 13 April 1997. Henry W. Robison.
182. Polk Co.: East Fork of Powell Creek north of Mena, AR (Sec. 33, T2S, R31W). 13 April 1997. Henry W. Robison.
183. Polk Co.: West Fork of Powell Creek (Sec. 31, T2S, R31W). 13 April 1997. Henry W. Robison.
184. Polk Co.: Two Mile Creek at FSR 173 Road (Sec. 11, T3S, R31W). 13 April 1997. Henry W. Robison.
185. Polk Co.: Little Brushy Creek at NFS Road (Sec. 6, T4S, R30W). 13 April 1997. Henry W. Robison.
186. Montgomery Co.: Roadside burrows, 0.9 mi. W. of Caddo Gap, AR (Sec. 12, T4S, R25W). 13 April 1997. H. W. Robison.
187. Pike Co.: Roadside ditch 2 mi. NW of Daisy, AR on U. S. Hwy. 70 (Sec. 15, T6S, R26W). 13 April 1997. H. W. Robison.
188. Polk Co.: Roadside ditch and stream, 0.2 mi. S of Posey Hollow Road on U. S. Hwy. 71 (Sec. 24, T1S, R30W). 11 May 1997. H. W. Robison.
189. Polk Co.: Roadside ditch, 0.3 mi. S of Posey Hollow Road on

- U. S. Hwy. 71 (Sec. 24, T1S, R30W). 11 May 1997. H. W. Robison.
190. Polk Co.: Roadside ditch, 0.5 mi. S of Posey Hollow Road on U. S. Hwy. 71 (Sec. 24, T1S, R30W). 11 May 1997. H. W. Robison.
191. Polk Co.: Roadside ditch, 0.7 mi. S of Posey Hollow Road on U. S. Hwy. 71 (Sec. 23, T1S, R30W). 11 May 1997. H. W. Robison.
192. Polk Co.: Unnamed trib. to Ouachita River, 1.2 mi. S of Posey Hollow Road on U. S. Hwy. 71 (Sec. 22, T1S, R30W). 11 May 1997. H. W. Robison.
193. Polk Co.: Stream runoff, 1.2 mi. N. of Acorn, AR (jct. of U. S. Hwys. 71 and 270) on U. S. Hwy. 71 (Sec. 22, T1S, R30W). 11 May 1997. H. W. Robison.
194. Polk Co.: Roadside ditch, 0.9 mi. N. of Acorn, AR on U. S. Hwy. 71 (Sec. 22, T1S, R30W). 11 May 1997. H. W. Robison.
195. Polk Co.: Roadside seepage and stream, 0.7 mi. N. of Acorn, AR on U. S. Hwy. 71 (Sec. 22, T1S, R30W). 11 May 1997. H. W. Robison.
196. Polk Co.: Ouachita River, gravel road west of Acorn, AR (Sec. 21, T1S, R30W). 11 May 1997. H. W. Robison.
197. Polk Co.: Roadside ditch, 0.5 mi. S of Acorn, AR on U. S. Hwy. 71 (Sec. 28, T1S, R30W). 12 May 1997. H. W. Robison.
198. Polk Co.: Roadside seepage and stream, 0.9 mi. S of Acorn, AR on U.S. Hwy. 71 (Sec. 28, T1S, 30W). 12 May 1997. H. W. Robison.

199. Polk Co.: Roadside seepage, 1.1 mi. S of Acorn, AR on U. S. Hwy. 71 (Sec. 33, T1S, R30W). 12 May 1997. H. W. Robison.
200. Polk Co.: Roadside seepage and small stream, 1.5 mi. S of Acorn on U. S. Hwy. 71 (Sec. 33, T1S, R30W). 12 May 1997. H. W. Robison.
201. Polk Co.: Roadside ditch and culvert with seepage, 2.3 mi. S. of Acorn, AR on U. S. Hwy. 71 (Sec. 4, T1S, R30W). 12 May 1997. H. W. Robison.
202. Polk Co.: Roadside seepage, 0.6 mi. N. of Mena, AR on U. S. Hwy. 71 (Sec. 9, T2S, R30W). 12 May 1997. H. W. Robison.
203. Clark Co.: Caddo River, 2.5 mi. NW of Amity, AR (Sec. 22, T5S, R23W). 17 May 1997. H. W. Robison.
204. Pike Co.: Little Missouri River at St. Hwy. 84, west of Langley, AR (Sec. 16, T5S, R27W). 17 May 1997. H. W. Robison.
205. Montgomery Co.: Little Missouri River at Camp Albert Pike (Sec. 16, T4S, R27W). 17 May 1997. H. W. Robison.
206. Howard Co.: Saline River, 3 mi. NW of Athens, AR (Sec. 8, T5S, R28W). 17 May 1997. H. W. Robison.
207. Howard Co.: Roadside burrows, 2.7 mi. NW of Dierks, AR on U. S. Hwy. 70 (Sec. 17, T7S, R28W). 17 May 1997. H. W. Robison.
208. Montgomery Co.: Shady Creek, ca. 5 mi. east of Mt. Ida, AR. (Sec. 26, T2S, R24W). 17 May 1997. H. W. Robison.
209. Montgomery Co.: South Fork of Ouachita River at Mt. Ida, AR at U. S. Hwy. 270 (Sec. 23, T2S, R25W). 17 May 1997. H. W.

Robison.

210. Montgomery Co.: Ouachita River at U. S. Hwy. 270 at Rocky Shoals (Sec. 30, T1S, R25W). 17 May 1997. H. W. Robison.
211. Montgomery Co.: Polk Creek, 1 mi. E. of Oden, AR (Sec. 26, T1S, R26W). 17 May 1997. H. W. Robison.
212. Montgomery Co.: Kates Creek, SW of Pine Ridge, AR (Sec. 29, T2S, R27W). 17 May 1997. H. W. Robison.
213. Polk Co.: Roadside seepage, 9.5 mi. NW of Mena, AR (Sec. 10, T1S, R30W) on U. S. Hwy. 71. 18 May 1997. H. W. Robison.
214. Polk Co.: Queen Wilhelmena State Park, NW of Wonder House (Sec. 11, T1S, R32W). 18 May 1997. H. W. Robison.
215. Polk Co.: Ouachita River at U. S. Hwy. 270 (Sec. 19, T1S, R30W). 18 May 1997. H. W. Robison.
216. Polk Co.: Irons Fork of the Ouachita River at St. Hwy. 88, 5.5 mi. E. of Mena, AR (Sec. 18, T2S, R29W). 18 May 1997. H. W. Robison.
217. Polk Co.: Unnamed trib, 2 mi. SE of Cherry Hill, AR (Sec. 9, T2S, R28W). 18 May 1997. H. W. Robison.
218. Polk Co.: Unnamed trib to Mt. Fork River, 10 mi. NW of Mena, AR (Sec. 29, T1S, R32W) on gravel road. 18 May 1997. H. W. Robison.
219. Polk Co.: Rock Creek at St. Hwy. 8, west of Mena, AR (Sec. 9, T2S, R31W). 18 May 1997. H. W. Robison.
220. Polk Co.: McKinney's Creek, 4.7 mi. NE of Hatfield, AR on U. S. Hwy. 71 (Sec. 27, T2S, R31W). 18 May 1997. H. W.

Robison.

221. Polk Co.: Cow Creek, 1 mi. NE. of Wickes, AR (Sec. 21, T5S, R31W) on gravel road. 18 May 1997. H. W. Robison.
222. Scott Co.: Poteau River at U. S. Hwy. 71 at Waldron, AR (Sec. 17, T3N, R29W). 19 May 1997. H. W. Robison.
223. Scott Co.: Poteau River, south of Bates, AR (Sec. 27, T3N, R32W) on gravel road. 19 May 1997. H. W. Robison.
224. Scott Co.: Brushy Creek, 9.3 mi. N. of Waldron, AR (Sec. 7, T4N, R29W). 19 May 1997. H. W. Robison.
225. Scott Co.: Kings Creek, 10.7 mi. N. of Waldron, AR (Sec. 6, T4N, R29W). 19 May 1997. H. W. Robison.
226. Garland Co.: Three Forks of Walnut Creek, 2.4 mi. west of Crystal Springs, AR (Sec. 32, T2S, R22W). 19 May 1997. H. W. Robison.
227. Garland Co.: Glazypeau Creek, five mi. SE of Mt. Valley, AR (Sec. 3, T2S, R20W). 19 May 1997. H. W. Robison.
228. Garland Co.: Glazypeau Creek at St. Hwy. 227 at Mt. Pine, AR (Sec. 8, T2S, R20W). 19 May 1997. H. W. Robison.
229. Polk Co.: Sugar Creek on Co. Rd. 602 south of Shady, AR (Sec. 4, T4S, R29W). 20 May 1997. H. W. Robison.
230. Montgomery Co.: Ouachita River at River Bluff Rec. Area (Sec. 24, T1S, R26W). 4 June 1997. H. W. Robison.
231. Montgomery Co.: Ouachita River at St. Hwy. 298, south of Sims, AR (Sec. 20, T1S, R25W). 4 June 1997. H. W. Robison.
232. Montgomery Co.: Mill Creek at St. Hwy. 27 south of Story, AR (Sec. 2, T1S, R24W). 4 June 1997. H. W. Robison.

233. Montgomery Co.: Irons Fork of Ouachita River at St. Hwy.
298 east of Fannie, AR (Sec. 35, T1N, R23W). 4 June 1997.
H. W. Robison.
234. Garland Co.: North Fork of Ouachita River at St. Hwy. 298
(Sec. 27, T1N, R22W). 4 June 1997. H. W. Robison.
235. Garland Co.: North Fork of Ouachita River at FSR (Sec. 7,
T1N, R21W). 4 June 1997. H. W. Robison.
236. Perry Co.: South Fourche la Fave River off St. Hwy. 314, 3
mi. east of Steve, AR (Sec. 32, T3N, R21W). 22 July 1997.
H. W. Robison.
237. Perry Co.: South Fourche la Fave River at Co. Rd. 116, 4
mi. west of Hollis, AR (Sec. 36, T3N, R21W). 22 July 1997.
H. W. Robison.
238. Perry Co.: Turner Creek at St. Hwy. 314 (Sec. 32, T3N,
R22W), ca. 3 mi. northeast of Onyx, AR. 22 July 1997.
H. W. Robison.
239. Perry Co.: Graham Creek at FSR 45 (Sec. 16, T2N, R22W). 22
July 1997. H. W. Robison.
240. Perry Co.: Cedar Creek at FSR 86, east of Hollis, AR (Sec.
28, T3N, R19W). 4 August 1997. H. W. Robison and David
Saugey.
241. Perry Co.: Pond by gravel area on FSR 86, east of Hollis,
AR (Sec. 28, T3N, R19W). 4 August 1997. H. W. Robison and
David Saugey.
242. Perry Co.: Unnamed tributary to Maumelle River at FSR 29340
(Sec. 14, T3N, R18W). 4 August 1997. H. W. Robison and

David Saugey.

243. Perry Co.: Brown Creek at St. Hwy. 324, ca. 2 mi. west of Williams Junction (Sec. 22, T3N, R17W). 4 August 1997. H. W. Robison and David Saugey.
244. Saline Co.: Unnamed tributary of Saline River at FSR 778 (Co. Rd. 48), 1/4 mi. west of Brown Corner (Sec. 23, T2N, R17W). 4 August 1997. H. W. Robison and David Saugey.
245. Saline Co.: Alum Fork of Saline River at FSR 2 west of Brown Corner (Sec. 29, T2N, R18W). 4 August 1997. H. W. Robison and David Saugey.
246. Saline Co.: Bread Creek at FSR 961 west of Brown Corner (Sec. 30, T2N, R18W). 4 August 1997. H. W. Robison and David Saugey.
247. Perry Co.: Dry Creek at St. Hwy. 7, south of Hollis, AR (Sec. 23, T2N, R20W). 6 August 1997. H. W. Robison.
248. Perry Co.: Bear Creek at St. Hwy. 7 (Sec. 2, T2N, R20W). 6 August 1997. H. W. Robison.
249. Perry Co.: South Fourche la Fave River at Hollis, AR (Sec. 34, T3N, R20W). 6 August 1997. H. W. Robison.
250. Perry Co.: Big Cove Creek at St. Hwy. 7 (Sec. 15, T3N, R20W). 6 August 1997. H. W. Robison.
251. Montgomery Co.: Caddo River at St. Hwy. 182, north of Amity, AR (Sec. 22, T5S, R23W). 10 October 1997. H. W. Robison and Field Biology Class.
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TABLE 2. Checklist of the Crayfishes of the Ouachita National Forest, Arkansas.

Fallicambarus strawni (Reimer)

Orconectes acares Fitzpatrick

Orconectes leptogonopodus Hobbs

Orconectes menae (Creaser)

Orconectes palmeri longimanus (Faxon)

Orconectes sp. nov.

Procambarus acutus (Girard)

Procambarus liberorum Fitzpatrick

Procambarus ouachitae

Procambarus parasimulans Hobbs and Robison

Procambarus reimeri Hobbs

Procambarus tenuis Hobbs

TABLE 3. Abundance of the Crayfishes of the Ouachita National Forest, Arkansas.

	Species		
	Abundance	Collections	Specimens
<u>Fallicambarus strawni</u>	Rare	3	5
<u>Orconectes acares</u>	Abundant	129	1,258
<u>Orconectes leptogonopodus</u>	Uncommon	12	54
<u>Orconectes menae</u>	Uncommon	2	4
<u>Orconectes palmeri</u>	Abundant	115	807
<u>Orconectes sp. nov.</u>	Common	5	67
<u>Procambarus acutus</u>	Uncommon	8	15
<u>Procambarus liberorum</u>	Rare	10	6
<u>Procambarus ouachitae</u>	Rare	2	4
<u>Procambarus parasimulans</u>	Rare*	0	0
<u>Procambarus reimeri</u>	Uncommon	10	52
<u>Procambarus tenuis</u>	Rare	2	2
Totals		298	2,274

* Presence based on collection by Dr. A. P. Blair verified by Dr. Horton H. Hobbs, Jr., Smithsonian Institution.

Table 4. Crayfishes of the Ouachita National Forest, Arkansas,
by Drainage.

Species	Red			Ouachita				Arkansas			
	*MtF	Cos	Sal	Ou	Cad	LM	Sal	Pot	FF	PJ	MA
<u>Fallicambarus</u>											
<u>F. strawni</u>	-	-	X	-	-	X	-	-	-	-	-
<u>Orconectes</u>											
<u>O. acares</u>	-	-	-	X	X	X	-	-	-	-	-
<u>O. leptogonopodus</u>	X	X	X	-	-	-	-	-	-	-	-
<u>O. menae</u>	-	-	-	X	-	X	-	-	-	-	-
<u>O. palmeri</u>	-	-	-	X	X	X	-	X	X	X	X
<u>O. sp. nov.</u>	-	-	-	-	-	-	X	-	-	-	X
<u>Procamburus</u>											
<u>P. acutus</u>	-	-	-	X	-	X	-	X	X	X	-
<u>P. liberorum</u>	-	-	-	-	-	-	-	X	X	-	-
<u>P. ouachitae</u>	-	-	-	-	-	-	X	-	-	-	-
<u>P. parasimulans</u>	-	-	-	-	X	-	-	-	-	-	-
<u>P. reimeri</u>	-	-	-	X	-	-	-	-	-	-	-
<u>P. tenuis</u>	-	-	-	X	-	-	-	-	-	-	-
Totals	1	1	2	6	3	5	2	3	3	2	2

* MtF = Mountain Fork River

Cos = Cossatot River

Sal = Saline River

Ou = Ouachita River and its direct tributaries

Cad = Caddo River

LM = Little Missouri River

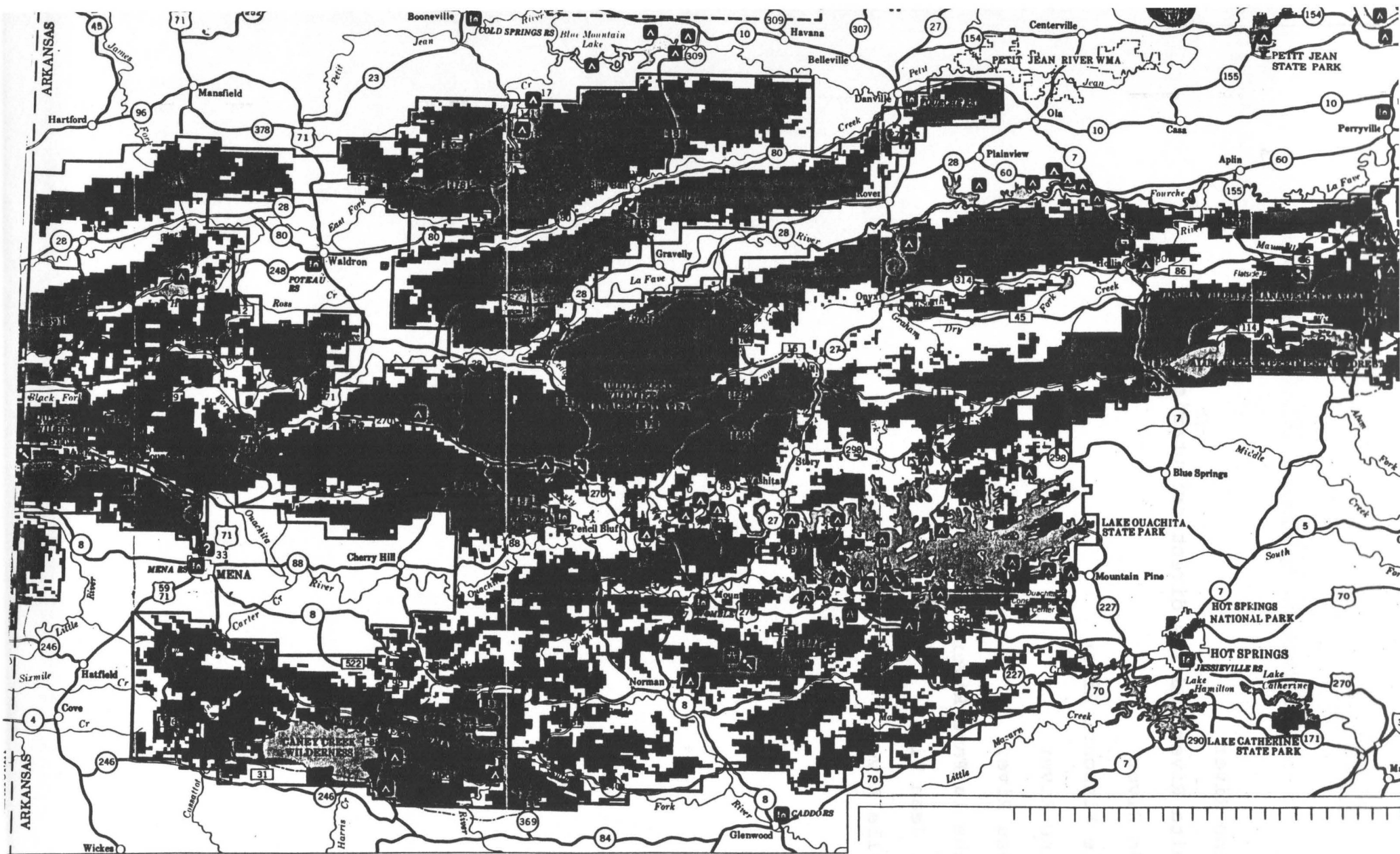
Sal = Saline River

Pot = Poteau River

FF = Fourche la Pave River

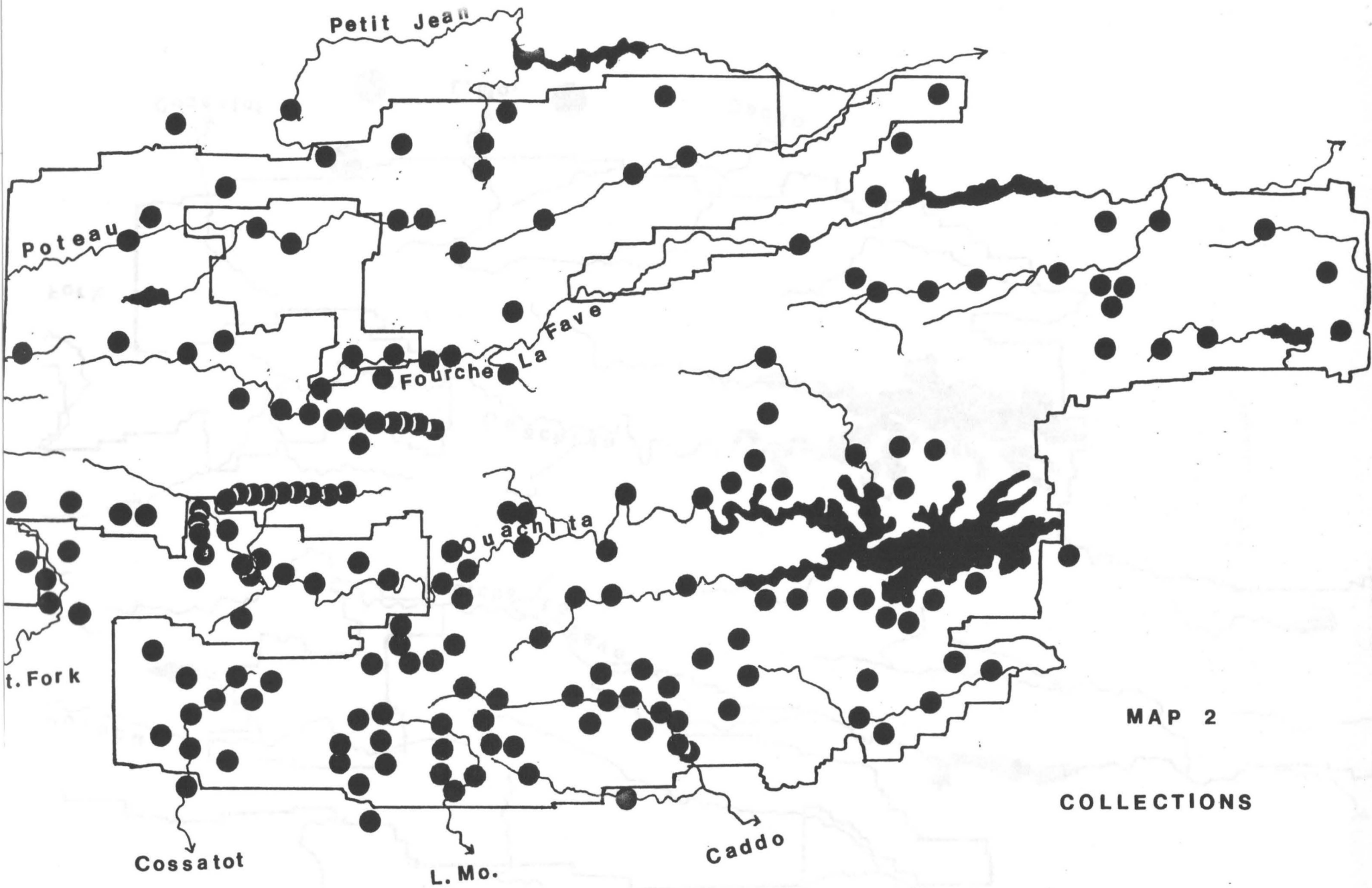
PJ = Petit Jean River

MA = Maumelle River

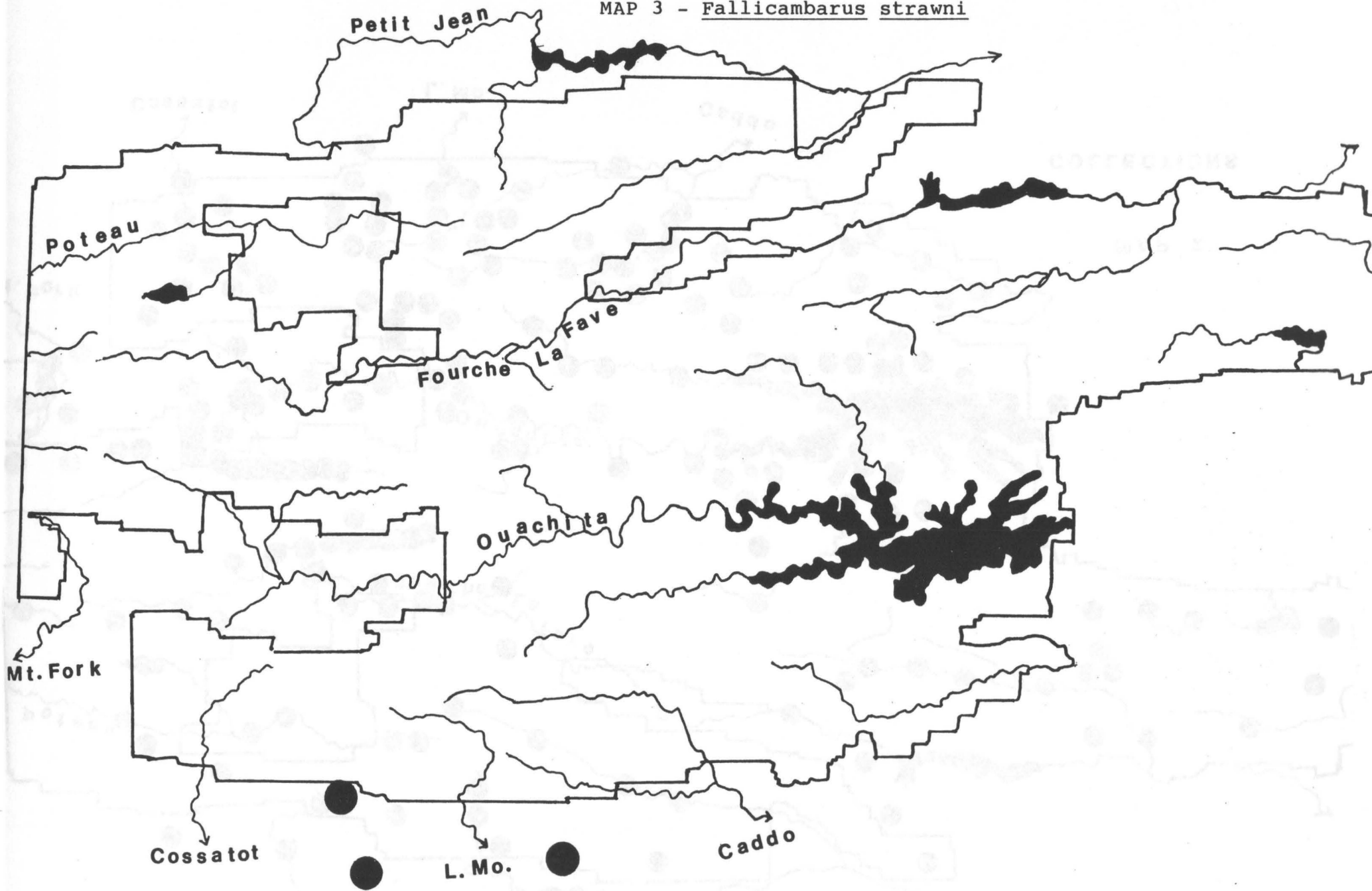


MAP 1

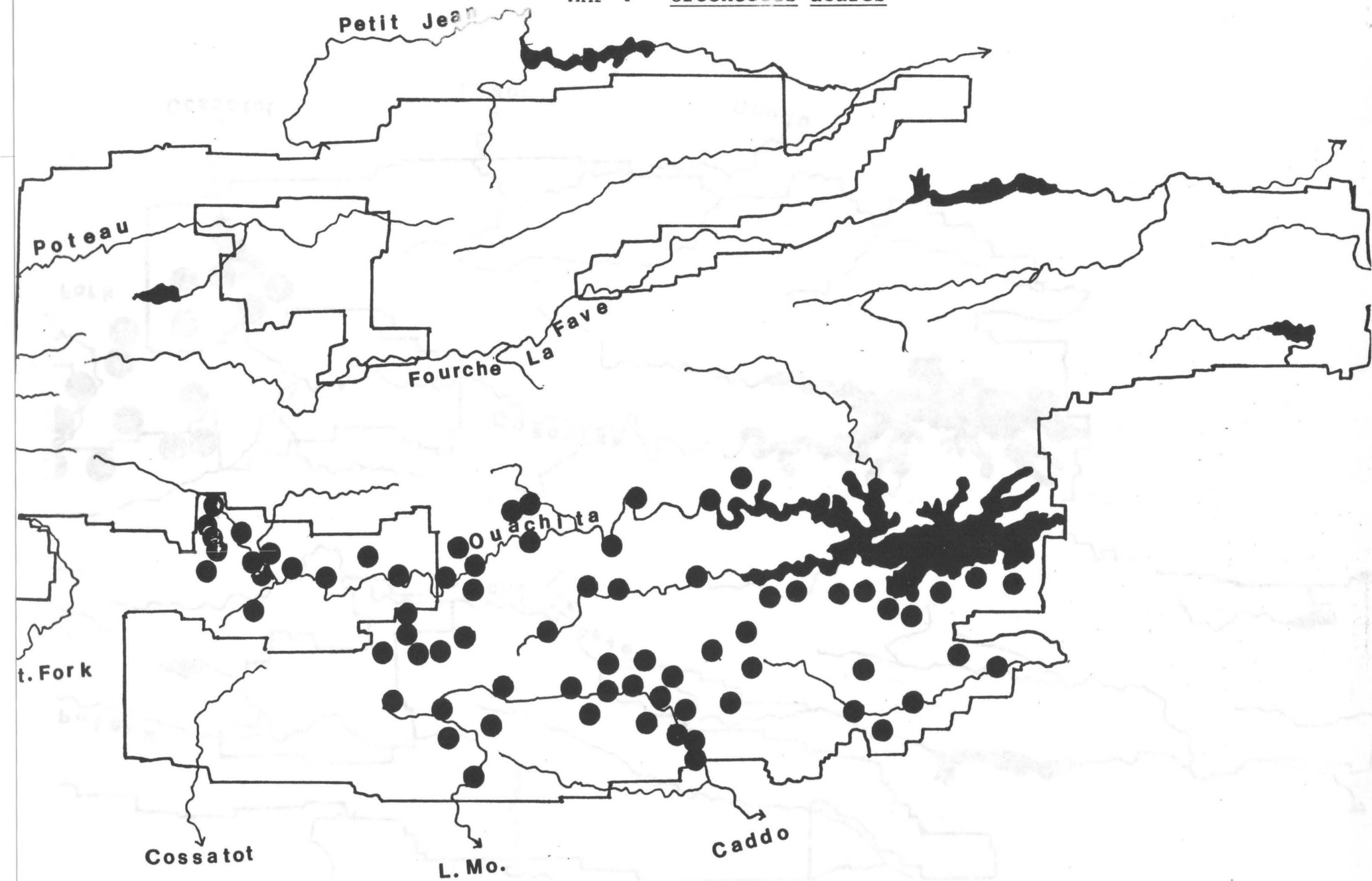
OUACHITA NATIONAL FOREST



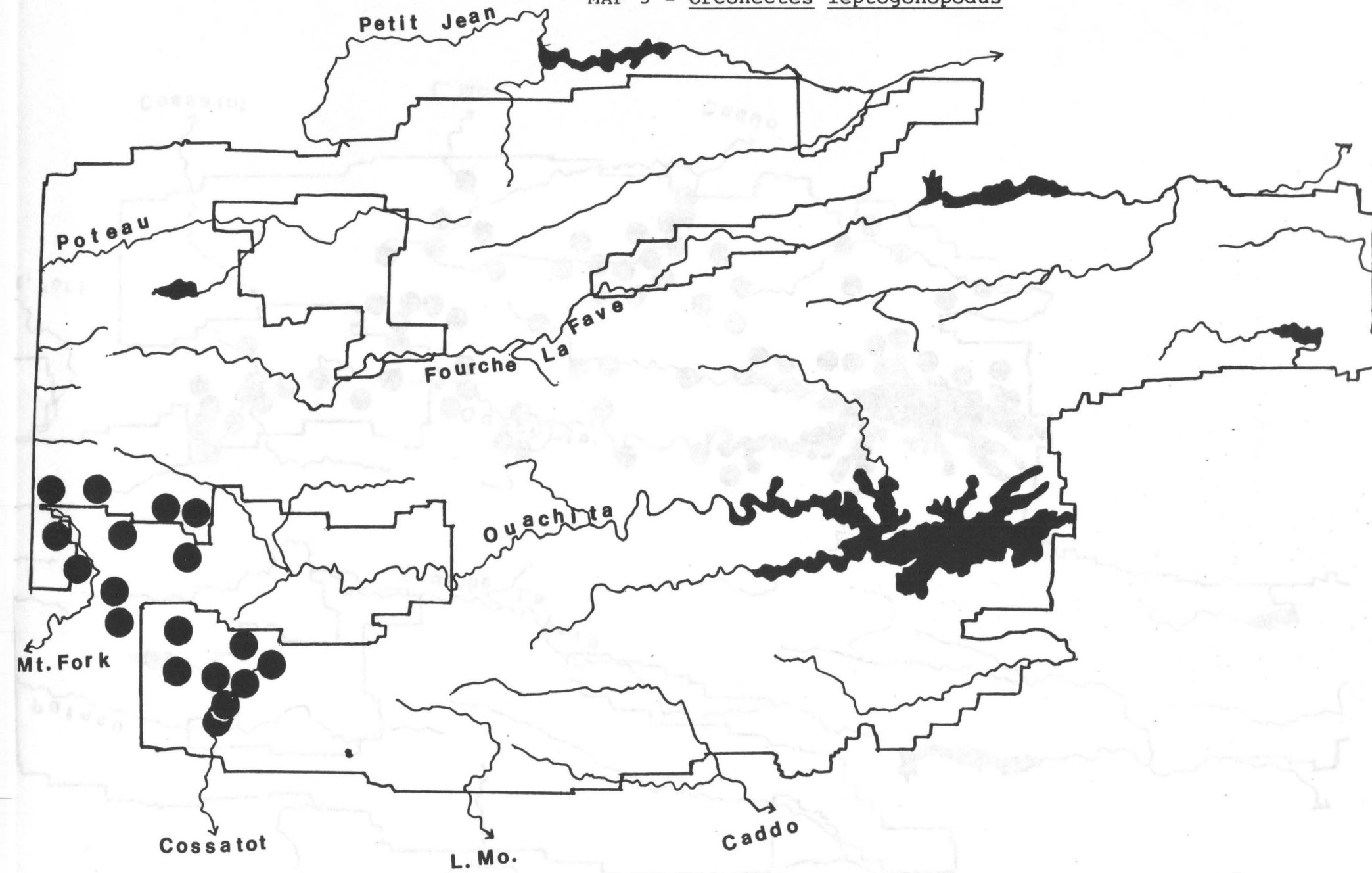
MAP 3 - Fallicambarus strawni



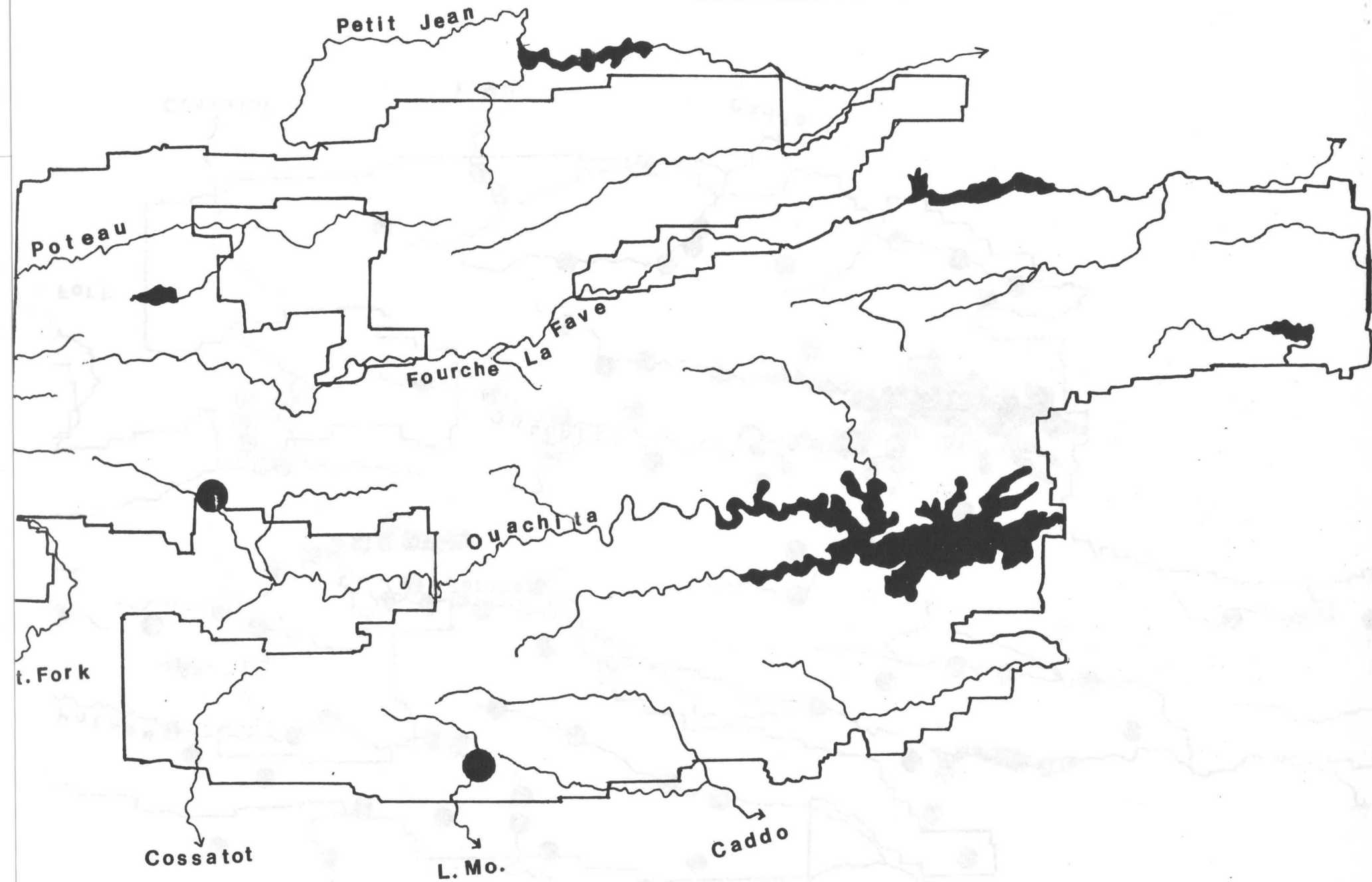
MAP 4 - Orconectes acareus



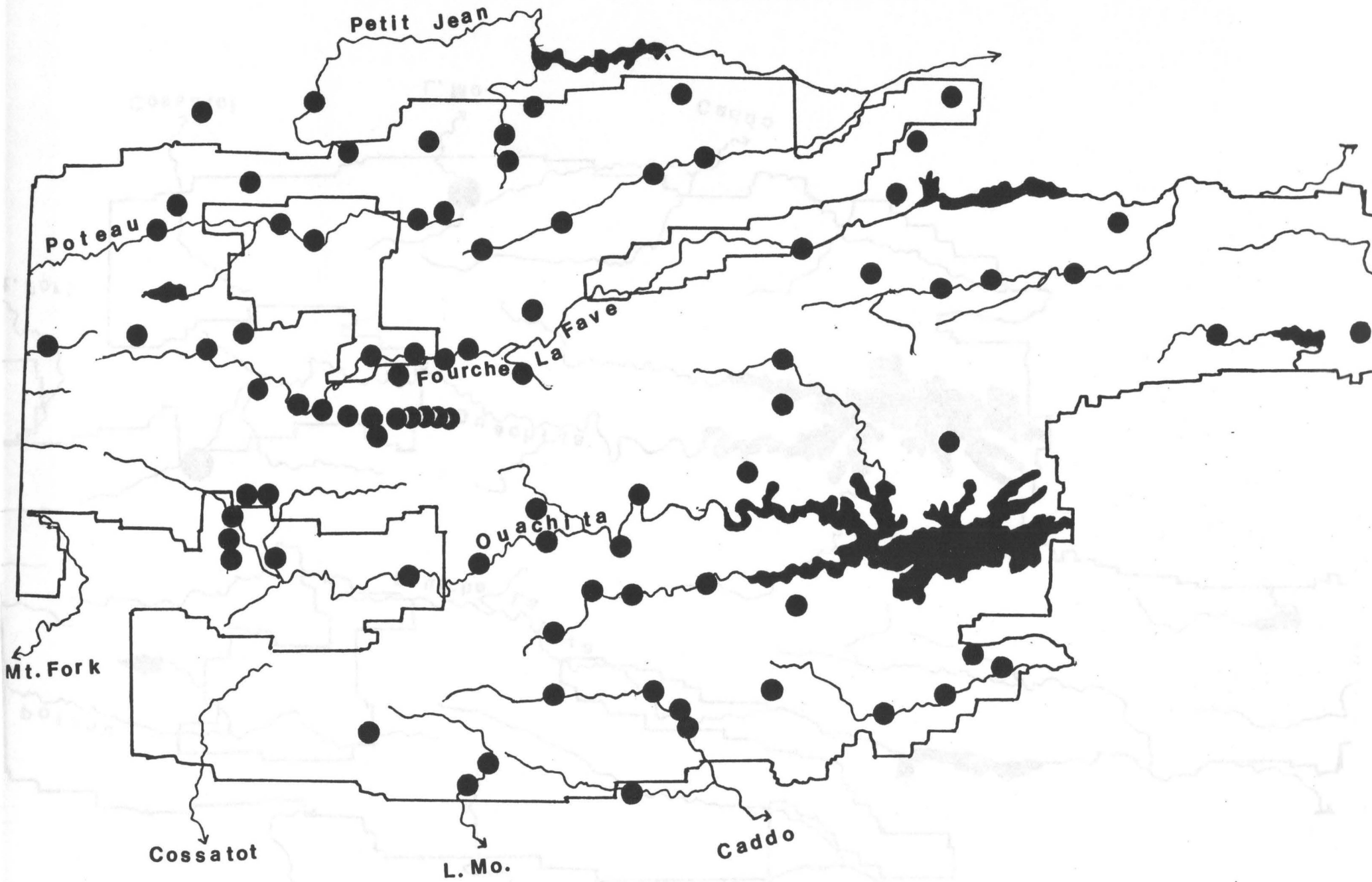
MAP 5 - Orconectes leptogonopodus



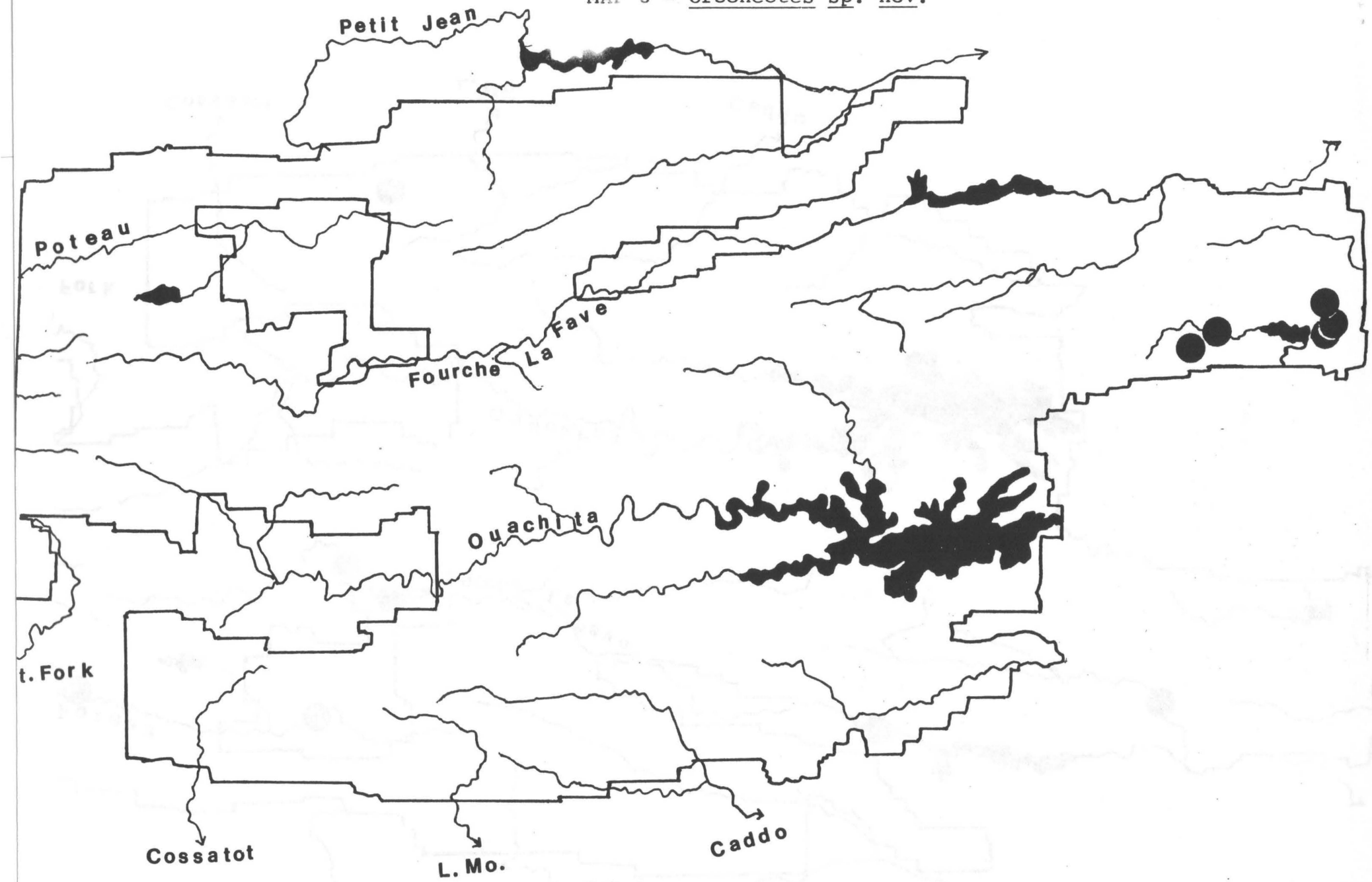
MAP 6 - Orconectes menae

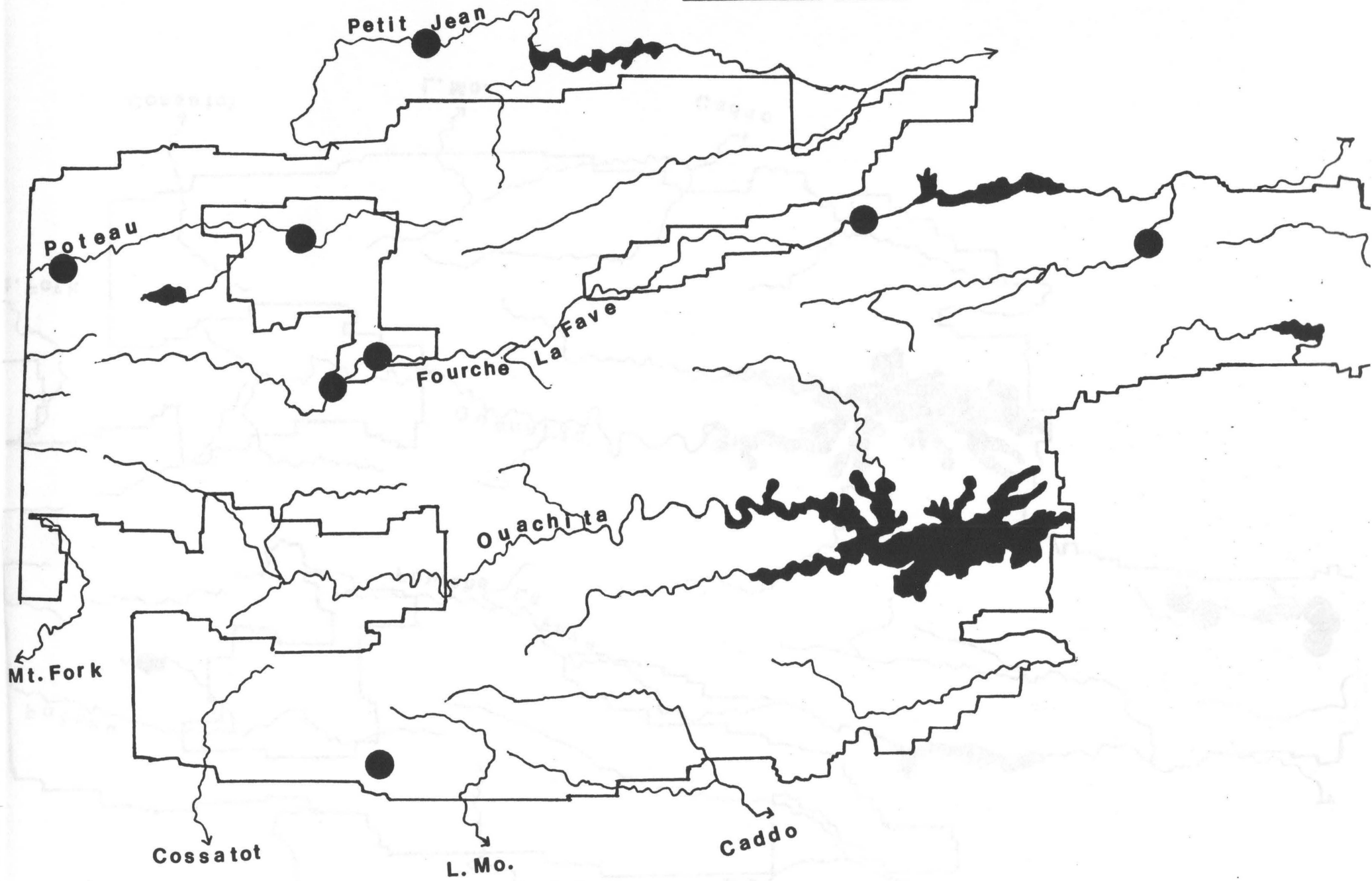


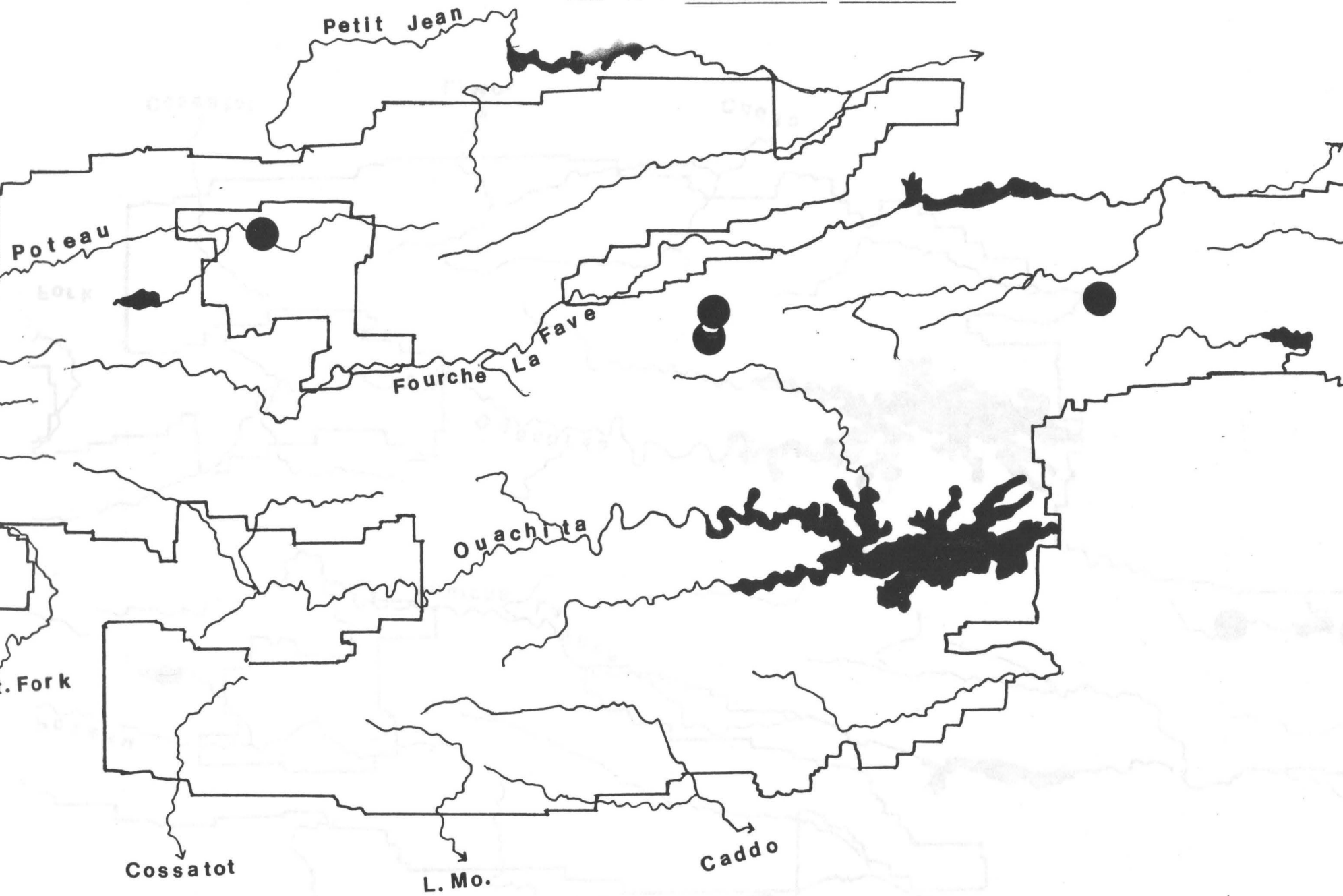
MAP 7 - Orconectes palmeri



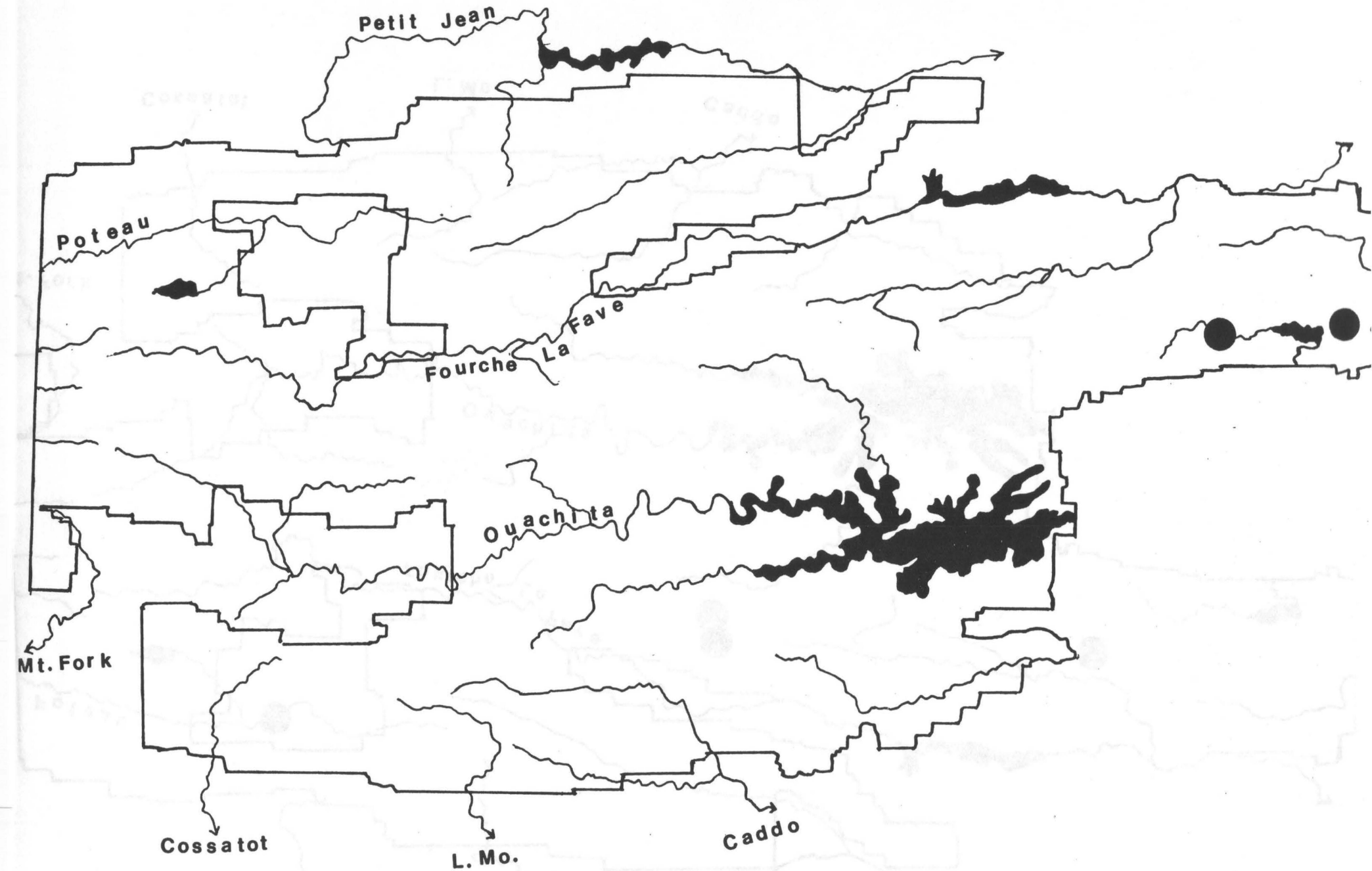
MAP 8 - Orconectes sp. nov.



MAP 9 - Procambarus acutus



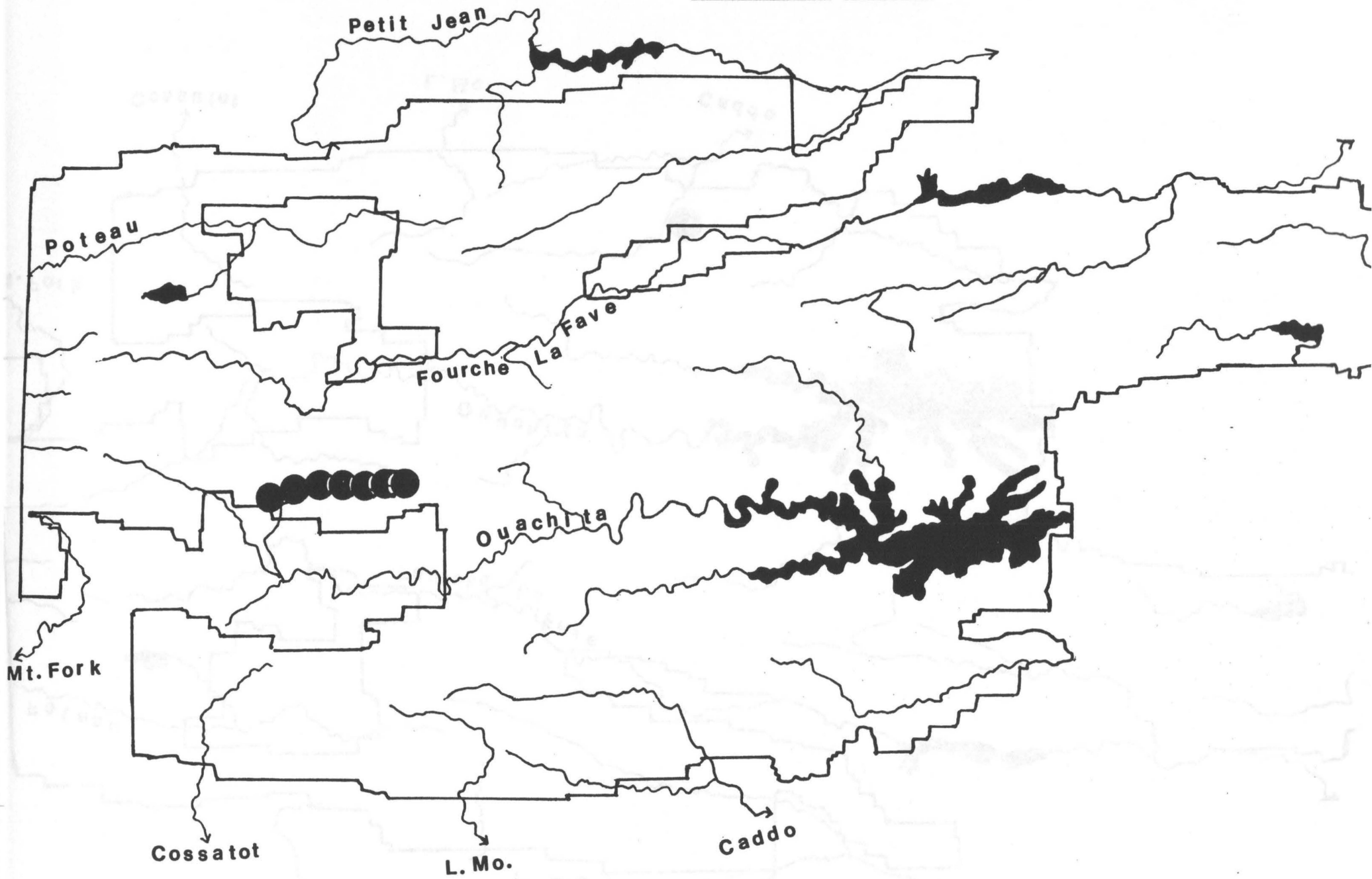
MAP 11 - Procambarus ouachitae



MAP 12 - Procambarus parasimulans



MAP 13 - Procambarus reimeri



MAP 14 - Procambarus tenuis



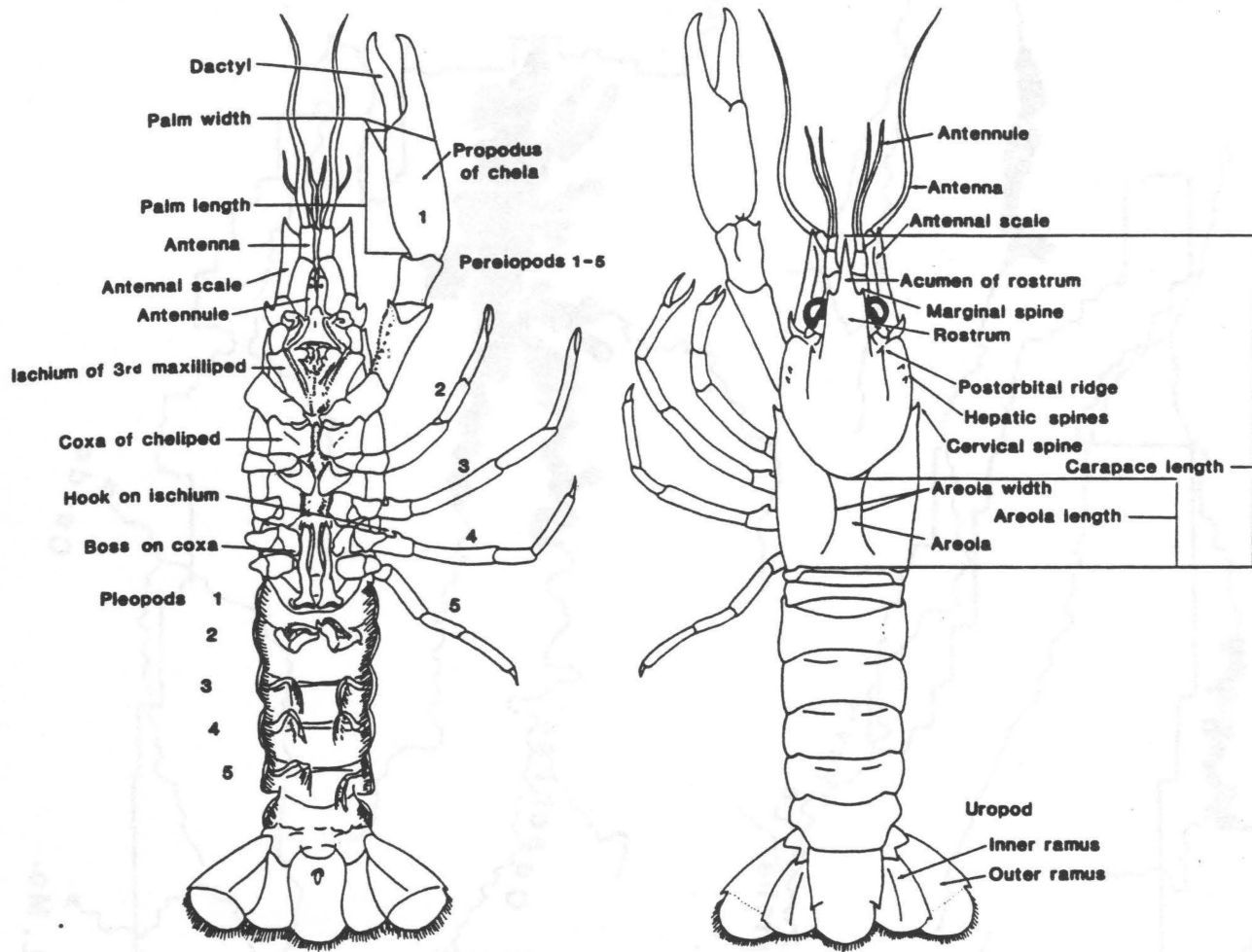


Figure 1 . Generalized diagram of cambarid crayfish: a, ventral view; b, dorsal view (after Hobbs et al. 1977).